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THE

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

(SECOND SERIES.)

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WITH FIFTY-EIGHT PLATES.

FOR THE YEAR 1895.

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CONTENTS OF VOL. X.

(SECOND SERIES.)

PART I.

(Issued September 9th, 1895.)

PAGE

On a new Species of Enteropneusta *(Ptychodera australiensis)* from the Coast of New South Wales. By JAS. P. HILL, Demonstrator of Biology, University of Sydney. (Plates I.-VIII.) 1

On a Platypus Embryo from the Intra-uterine Egg. By JAS. P. HILL, Demonstrator of Biology, and C. J. MARTIN, M.B., B.Sc. (Lond.), Demonstrator of Physiology, in the University of Sydney. (Plates IX.-XIII.) 43

A Review of the Fossil Jaws of the *Macropodidæ* in the Queensland Museum. By C. W. DE VIS, M.A., Corresponding Member. (Plates XIV.-XVIII.) 75

Presidential Address. By Professor T. W. E. DAVID, B.A., F.G.S. 134

Description of a Flycatcher, presumably new. By C. W. DE VIS, M.A., Corresponding Member... 171

On the Specific Identity of the Australian Peripatus, usually supposed to be *P. leuckarti*, Sänger. By J. J. FLETCHER 172

Description of *Peripatus oviparus*. By ARTHUR DENDY, D.Sc., Professor of Biology in the Canterbury College, University of New Zealand 195

Notes on the Sub-Family *Brachyscelinæ*, with Descriptions of New Species. Part iv. By WALTER W. FROGGATT. (Plate XIX.) ... 201

On a Fiddler *(Trygonorhina fasciata)*, with abnormal Pectoral Fins. By JAS. P. HILL, Demonstrator of Biology, in the University of Sydney. (Plate XX.) 206

Office-bearers and Council for 1895 161

Donations 163

Notes and Exhibits 209

PART II.

(Issued November 18th, 1895.)

PAGE

Oological Notes. By ALFRED J. NORTH, F.L.S., Australian Museum, Sydney 215

Note on the Correct Habitat of *Patella (Scutellastra) kermadecensis*, Pilsbry. By T. F. CHEESEMAN, F.L.S., Curator of the Auckland Museum. *(Communicated by the Secretary)* 221

Descriptions of New Species of Australian Coleoptera. Part ii. By ARTHUR M. LEA 224

On two new Genera and Species of Fishes from Australia. By J. DOUGLAS OGILBY. (*Communicated by the Secretary*) 320

Life-Histories of Australian Coleoptera. Part iii. By WALTER W. FROGGATT... 325

A Giant Acacia from the Brunswick River. By J. H. MAIDEN, F.L.S. (Plate XXI.) 337

Descriptions of some new *Araneidæ* of New South Wales. No. 5. By W. J. RAINBOW. (Plates XXII.-XXIII.)... 347

Notes on the Methods of Fertilisation of the *Goodeniaceæ*. Part ii. By ALEX. G. HAMILTON. (Plate XXIV.) 361

On a new fossil Mammal allied to *Hypsiprymnus*, but resembling in some points the *Plagiaulacidæ*. By ROBERT BROOM, M.B., C.M., B.Sc. [Title.] 373

On some new or hitherto little known Land Shells from New Guinea or adjacent Islands. By C. F. ANCEY, Administrateur-Adjoint, Dra-el-Mizan, Algeria. (Plate XXVI.) *(Communicated by C. Hedley)* 374

Plants of New South Wales Illustrated. No. viii. *Acacia lanigera*, A. Cunn. By R. T. BAKER, F.L.S. Assistant Curator, Technological Museum, Sydney. (Plate XXVII.) 382

Description of a new Species of *Acacia* from New South Wales. By J. H. MAIDEN, F.L.S., and R. T. BAKER, F.L.S. (Plate XXVIII.) 385

Elections and Announcements 211, 343

Donations 211, 343

Notes and Exhibits 341

PART III.

(Issued January 31st, 1896.)

PAGE

Anthropological Notes. By Richd. Helms. *(Communicated by the Secretary).* (Plates xxix.-xxx.) 387

Australian *Termitidæ*. Part i. By Walter W. Froggatt 415

Meliola amphitricha, Fries. By D. McAlpine. *(Communicated by J. H. Maiden).* (Plate xxxi. Figs. 1-5) 439

Notes on *Uromyces amygdali*, Cooke: A Synonym of *Puccinia pruni*, Pers., (Prune Rust). By D. McAlpine. *(Communicated by J. H. Maiden).* (Plates xxxi. [lower division], xxxii.. xxxiii.) ... 440

Puccinia on Groundsel, with Trimorphic Teleutospores. By D. McAlpine. *(Communicated by J. H. Maiden).* (Plates xxxiv.-xxxvi.) 461

On a New Species of *Eleocarpus* from Northern New South Wales. By J. H. Maiden, F.L.S., and R. T. Barker, F.L.S. (Plate xxxvii.) 469

New Species of Cone from the Solomon Islands. By J. Brazier, F.L.S., C.M.Z.S. 471

On the Homology of the Palatine Process of the Mammalian Premaxillary. By R. Broom, M.B., C.M., B.Sc. 477

The Silurian Trilobites of New South Wales, with References to those of other Parts of Australia. By R. Etheridge, Junr., Curator of the Australian Museum--and John Mitchell, Public School, Narellan. Part iii. The *Phacopidæ*. (Plates xxxviii.-xl.) 486

Botanical Notes from the Technological Museum. By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S. No. iv. (Plates xli.-xlii.) ... 512

Catalogue of the Described Coleoptera of Australia. Supplement, Part I. *Cicindelidæ* and *Carabidæ*. By George Masters.*

Elections and Announcements 411, 474

Donations 411, 474

Notes and Exhibits 409, 472

PART IV.

(Issued April 29th, 1896.)

PAGE

Notes on *Cicadas*. By Walter W. Froggatt 526

On the Dates of Publication of the Early Volumes of the Society's Proceedings. By J. J. Fletcher 533

* Issued separately as a Supplement to the Part (the pagination of the Catalogue being continued).

PART. IV. *(continued).*

PAGE

Description of a Tree Creeper, presumably new. By C. W. De Vis, M.A., Corr. Member. [Title] 536

The Grey Gum of the North Coast Districts *(Eucalyptus propinqua*, sp.nov.) By Henry Deane, M.A , F.L.S., and J. H. Maiden, F.L.S. (Plate xliii.) 541

Jottings from the Biological Laboratory of Sydney University. By Professor William A. Haswell, M.A., D.Sc. No. 18.—Note on Certain Points in the Arrangement and Structure of the Tentaculiferous Lobes in *Nautilus pompilius* (Plate xlviii.) ... 544

On the Occurrence of Diatomaceous Earth at the Warrumbungle Mountains, N.S.W. By Professor T. W. Edgeworth David, B.A., F.G.S. [Title] 548

On some Developments of the Mammalian Prenasal Cartilage. By R. Broom, M.D., B.Sc. (Plate xliv.) 555

On a small Fossil Marsupial with large Grooved Premolars. By R. Broom, M.D., B Sc. (Plates xxv. and xlv.) 563

On a small Fossil Marsupial allied to *Petaurus*. By R. Broom, M.D., B.Sc. (Plate xlvi.) 568

On the Organ of Jacobson in an Australian Bat *(Miniopterus)*. By R. Broom, M.D., B.Sc. (Plate xlvii.) 571

Note on the Period of Gestation in *Echidna*. By R. Broom, M.D., B.Sc. 576

Preliminary Note on the Occurrence of a Placental Connection in *Perameles obesula*, and on the Fœtal Membranes of certain Macropods. By Jas. P. Hill, Demonstrator of Biology in the University of Sydney. (Plate xlix.) 578

Descriptions of some New Species of Plants from New South Wales. By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S. (Plates l.-liii.) 582

Observations on the Eucalypts of New South Wales. Part i.—By Henry Deane, M.A., F.L.S., and J. H. Maiden, F.L.S. (Plates liv.-lvii.) 596

Stray Notes on Papuan Ethnology. By C. Hedley, F.L.S. (Plate lviii.) 613

Presidential Address. By Henry Deane, M.A., F.L.S. 619

Office-bearers and Council for 1896 668

Elections and Announcements and Donations 522, 538, 551

Notes and Exhibits 519, 537, 549, 618

CORRIGENDA.

Page 78, in the last two lines—read *O. frenata* and *P. penicillata.*

Page 84, line 27—*insert* m.^{1} between mp.^{4} and m.^{2}

Page 85, line 15—*add* ; of the entire series of cheek teeth 98·5 (1).

Page 87, line 26—*for* premolars *read* the left premolar.

Page 88, line 4—*for* A second example, hinder portion, &c., *read* A second example—Hinder portion, &c.

Page 89, line 15—for *orcas* read *oreas.*

Page 93, line 4—after young *add* Cast of portion of a right maxilla with m.^{3} m.^{4} (10223) ; adult.

Page 94, line 5—The word but at the end of the line should have been omitted.

Page 99, lines 17, 29 and 31—*for* P.^{4} *read* in each case $\overline{\text{P.}^{4}}$

Page 100, line 2—*for* P.^{4} *read* $\overline{\text{P.}^{4}}$

Page 107, line 35—*for* lightly *read* slightly.

Page 467, line 18—for *Puccini pruni* read *Puccinia pruni.*

LIST OF PLATES.

VOL. X.

(SECOND SERIES).

Plates I.-VIII.—*Ptychodera australiensis*, Hill.

Plates IX.-XIII.—Platypus Embryo from the Intra-uterine Egg.

Plates XIV.-XVIII.—Fossil Jaws of the *Macropodidæ*.

Plate XIX.—Brachyscelid Galls.

Plate XX.—*Trygonorhina fasciata* with abnormal Pectoral Fins.

Plate XXI.—*Acacia Bakeri*, Maiden.

Plates XXII.-XXIII.—Australian Spiders *(Nephila Fletcheri, N. Edwardsi,* and *N. ventricosa).*

Plate XXIV.—Fertilisation of the *Goodeniaceæ*.

Plates XXV. and XLV.—A Fossil Marsupial *(Burramys parvus*, Broom).

Plate XXVI.—New Land Shells from New Guinea.

Plate XXVII.—*Acacia lanigera*, A. Cunn.

Plate XXVIII.—*Acacia pumila*, Maiden et Baker.

Plate XXIX.—Aboriginal Stone Implements.

Plate XXX.—Aboriginal Grave.

Plate XXXI. (upper division)—*Meliola amphitricha*, Fries.

Plate XXXI. (lower division)-XXXIII.—Prune Rust *(Puccinia pruni*, Pers.)

Plates XXXIV.-XXXVI.—*Puccinia* on Groundsel.

Plate XXXVII.—*Elæocarpus Bacuerleni*, Maiden et Baker.

Plates XXXVIII.-XL.—Silurian Trilobites of New South Wales.

Plates XLI.-XLII.—*Piptocalyx Moorei*, Oliv., and *Cryptocarya microneura*, Meissn.

Plate XLIII.—*Eucalyptus propinqua*, Deane et Maiden.

Plate XLIV.—The Prenasal Cartilage of certain Mammals.

Plates XLV. and XXV.—A Fossil Marsupial *(Burramys parvus*, Broom).

Plate XLVI.—*Palæopetaurus elegans*, Brown.

Plate XLVII.—The Organ of Jacobson in *Miniopterus*.

Plate XLVIII.—Tentaculiferous Lobes of *Nautilus pompilius*.

Plate XLIX.—Fœtal Bandicoot *(Perameles obesula)* showing a Placental Connection.

Plate L.-LIII.—New Species of Plants from New South Wales.

Plates LIV.-LVII.—Eucalypts of New South Wales.

Plate LVIII.—Papuan Carving and Basket.

NOTES AND EXHIBITS.

Mr. North exhibited a set of four eggs of *Turnix leucogaster*, recently described by him. The eggs were taken at Illamurta, Central Australia, on the 18th of June, 1895; and are of a buffy-white ground-colour, minutely freckled and sparingly spotted with different shades of chestnut-brown, purplish-brown, and violet-grey; an average specimen measuring 0·9 × 0·73 inch.

Mr. Steel showed a very large specimen of a ship-worm (*Teredo*) from redgum (?) piles in the fresh water of the Rewa River, Fiji, collected by Mr. T. Ferguson.

Mr. Froggatt showed a representative collection of some eighty named species of Australian Ants (*Formicidæ*). Also specimens of a beetle (*Arthropterus brevis*, Westw.) belonging to the family *Paussidæ*, captured in the nests of a common Australian Ant (*Ecatomma metallicum*). African species of this family commonly occur in such situations, but the exhibitor was unaware of any record of this habit in Australian species.

Messrs. Maiden and Baker exhibited a number of plants and photos in illustration of their paper.

Messrs. Etheridge and Mitchell exhibited a number of Trilobites in illustration of their paper.

Mr. Mitchell exhibited several specimens of *Glossopteris* from Croudace's Hill, near Lambton, Newcastle, showing very apparent evidences of what is probably fructification similar to that of an *Asplenium*. Some specimens of a like character were collected by him from the cliffs on the Old Race Course Beach. Also a specimen of what appears to be a *Lycopodium*, near *L. gutbieri*, Göpp., or *L. macrophyllum*, Gold., from the South Bulli Colliery. This is the first record of a fossil Lycopod from the New South Wales coal-bearing series.

Mr. Henn exhibited, on behalf of Mrs. G. J. Waterhouse, a very fine collection of *Cypræidæ*, found alive by herself and sons in Port Jackson, between the months of May and August of this year. The collection consisted of exactly 100 specimens belonging to the seventeen following species:—*Cypræa fimbriata*, Gmelin, *C. macula*, A. Ad., *C. felina*, Gmelin, *C. assellus*, Linn., *C. tabescens*, Solander, *C. arabica*, Linn., *C. moneta*, Linn., *C. annulus*, Linn., *C. caput-serpentis*, Linn., *C. helvola*, Linn., *C. clandestina*, Linn., *C. flaveola*, Linn., *C. lutea*, Gronovius, *C. comptoni*, Gray, *C. errosa*, Linn., *C. errones*, Linn., and *C. interpunctata*, Brazier, MS. The last, (of which two specimens were found) differs from *C. macula*,—which it otherwise much resembles —in being more pyriform, and much more profusely and distinctly marked with spots. It is considered by Mr. Brazier to be a distinct new species, but it would, perhaps, be more correctly described as *C. macula*, A. Ad., var. *interpunctata*, Brazier.

Of the above, no less than nine species, viz.: *C. fimbriata*, *tabescens*, *arabica*, *moneta*, *helvola*, *flaveola*, *lutea*, *comptoni*, and *interpunctata*, have never been previously recorded from Port Jackson. The *Cypræidæ* are amongst the rarest shells in the harbour, and very few—even dead—specimens have come to light for some years past. It is all the more remarkable therefore that so large a number of species should suddenly be discovered. They were found under stones rather below extreme low water mark and, with two exceptions, all within a radius of one hundred yards. In addition to the above, Mrs. Waterhouse also found dead specimens of *C. caput-anguis* and *C. hirundo* in very good condition, neither of which has been previously recorded from Port Jackson.

Mr. Henn also exhibited three extremely fine specimens of *C. vitellus*, Linn., and a specimen of *Micromelo guamensis*, Quoy et Gaimard, all found alive at Botany Heads by Mr. Norman Hansard in July. The latter very beautiful little shell has never been recorded from Australia previously, but is a native of the South Sea Islands.

Mr. Edgar R. Waite exhibited a number of photographs of Tree Kangaroos (*Dendrolagus bennettianus*, De Vis), at present living in the Melbourne Zoological Gardens, sent by Mr. D. le Souëf. Some of the kangaroos are sitting on the topmost branches of the trees, which have been defoliated even to the extreme tips of the branches. Other photographs show the animals on the ground in truly macropine positions; but one in which the kangaroo is on "all fours" indicates that the fore limbs are probably being more freely used in terrestrial progression than usual.

WEDNESDAY, SEPTEMBER 25TH, 1895.

The Ordinary Monthly Meeting of the Society was held at the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, September 25th, 1895.

The President, Mr. Henry Deane, M.A., M.I.C.E., in the Chair.

DONATIONS

Pharmaceutical Journal of Australasia. Vol viii. No. 8 (Aug. 1895). *From the Editor.*

Royal University of Upsala:—(*a*) Bulletin of the Geological Institution. Vol. i. (two Parts), Vol. ii. Part 1 (1892-94): (*b*) Arsskrift, Mathematik och Naturvetenskap, 1870, 1, 3: 1872, 1: 1873, 2: 1874, 2: 1875, 1, 4, 5: 1878, 1: 1892, Program 1: (*c*) Vega-Expeditionens Vetenskapliga Arbeten — Eight Botanical and Zoological Excerpts from Bd. i.-iv. (1882-85): (*d*) Meddelanden från Ups. Univers. Mineralogisk-Geologiska Institution. Nos. 1-10 and 12-13 (8vo. 1891-94): (*e*) Sveriges Geologiska Undersökning. Ser. C. Afhandlingar. Nos. 60, 76, 78, 88, 95: (*f*) Ten Inaugural Dissertations, 8vo. (1872-95): (*g*) Eight Inaugural Dissertations, 4to. (1885-92): (*h*) Thirty-six Miscellaneous Pamphlets, 8vo. and 4to. *From the University.*

Department of Mines, Victoria—Progress Report. No. viii (1894) and Twelve Special Reports (1892-95). *From the Secretary for Mines.*

Department of Agriculture, Brisbane — Bulletin. Second Series, Nos. 6-7 (1895): Botany Bulletin. No. xi. (1895). *From the Secretary for Agriculture.*

K.K. Zoologisch-botanische Gesellschaft in Wien—Verhandlungen. Bd. xlv. Heft 6. *From the Society.*

Zoologischer Anzeiger. xviii. Jahrgang (1895). Nos. 480-482 (July 22nd-Aug. 19th). *From the Editor.*

Perak Government Gazette. Vol. viii. Nos. 20-21 (Aug. 1895). *From the Government Secretary.*

Bombay Natural History Society—Journal. Vol. ix. No. 4 (1895). *From the Society.*

Société des Sciences de Finlande—Observations Météorologiques, 1889-90, and 1893 (Vol. xii. Liv. 2). [Two Parts.] *From the Society.*

Geological Society, London—Quarterly Journal. Vol. li. Part 3 (No. 203, Aug. 1895). *From the Society.*

Museo di Zoologia, &c., della R. Universitá di Torino—Bulletin. Vol. x. Nos. 193-209. *From the Museum.*

Royal Geographical Society of Australasia—Queensland Branch —Proceedings and Transactions. Vol. x. (1894-95). *From the Society.*

Department of Agriculture, Sydney—Agricultural Gazette of N.S.W. Vol. vi. Part 8 (Aug. 1895); Cooke's "Handbook of Australian Fungi" (8vo. 1892). *From the Hon. the Minister for Mines and Agriculture.*

Baron von Mueller's "Select Extra-Tropical Plants." Ninth Edition (1895). *From the Premier of Victoria through the Librarian, Public Library, Melbourne.*

Royal Swedish Academy, Stockholm—Oefversigt. Vol. li. (1894): Hj. Theel's "Oem Sveriges zoologiska hafsstation Kristineberg" (8vo. 1895). *From the Academy.*

Indian Museum—Notes. Vol. iii. Nos. 4-5 (1894-5): Pamphlet entitled "Description of a New Species of Oxyrhynch Crab." By A. Alcock, M.B. (1895). *From the Superintendent.*

Bureau of Agriculture, West Australia—Journal. Vol. ii. Nos. 18-19 (Aug.-Sept. 1895). *From the Secretary.*

Société Impériale des Naturalistes de Moscou—Bulletin. Année 1895. No. 1. *From the Society.*

Victorian Naturalist. Vol. xii. No. 5 (Aug. 1895). *From the Field Naturalists' Club of Victoria.*

American Naturalist. Vol. xxix. (1895), No. 344 (Aug.) *From the Editors.*

Harvard College, Cambridge, Mass.—Bulletin of the Museum of Comparative Zoology. Vol. xxviii. No. 1. *From the Curator.*

Connecticut Academy of Arts and Sciences—Transactions. Vol. ix. Part 2 (1895). *From the Academy.*

American Geographical Society—Bulletin. Vol. xxvii. Part 2. *From the Society.*

Department of Lands and Survey, New Zealand—Report for the Year 1894-95. *From H. Farquhar, Esq.*

Konink. Naturkund. Vereeniging in Nederl.-Indië—Natuurkundig Tijdschrift. Deel liv. (1895). *From the Society.*

Société Entomologique de France—Annales. Année 1893 (Vol. lxvii.). *From the Society.*

Journal de Conchyliologie. Vol. xli. (3^{e}. Sér. T. xxxiii., 1893). *From the Editor.*

Faculté des Sciences de Marseille—Annales. T. iv. Fasc. 1-3: Annales de l'Institut Botanico-Géologique de Marseille. Vol. i. (1893). *From the Society.*

Société des Sciences de l'Ouest de la France—Bulletin. T. iv. 2er-4^{e} Trim. : T. v. 1er Trim. *From the Society.*

Société Linnéene de Normandie—Bulletin. 4e Série. Vol. vii. (1893). *From the Society.*

Asiatic Society of Bengal—Journal. Vol. lxiii. Part i. Title-Page and Index : Vol. lxiv. Part i. No. 1 : Vol. lxiv. Part ii. No. 2 : Proceedings 1895. Nos. 4-6 (Ap.-June). *From the Society.*

Conchological Society of Great Britain and Ireland—Journal of Conchology. Vol. viii. No. 3 (July, 1895). *From the Society.*

Australian Museum, Sydney—Records. Vol. ii. No. 6 (Sept. 1895). *From the Trustees.*

Australasian Journal of Pharmacy. Vol. x. No. 117 (Sept. 1895). *From the Editor.*

British Museum (Nat. Hist.)—Catalogue of Fishes, 2nd Edition. Vol. i. By G. A. Boulenger, F.R S. (1895) : Catalogue of the Spiders of Burma. By T. Thorell (1895). *From the Trustees.*

Royal Society, London—Proceedings. Vol. lvii. Nos. 347-348. *From the Society.*

NOTES ON *CICADAS*.

By Walter W. Froggatt.

Regularly every season as the warm summer days set in, toward the latter part of the year, the shrill call of the Cicadas, or "locusts" as they are popularly called, is heard with monotonous regularity in every cluster of trees or shrubs about Sydney. It is noticeable that every third year they appear in much greater numbers than in the two preceding seasons; and with the well known fact before us that the American "Seventeen-year Cicada" (*C. septemdecim*) reappears every seventeenth year, I am led to the conclusion that several of our larger species take three years to reach maturity.

During this last season (1894-5) they appeared in countless numbers all round the neighbourhood of Sydney, and were much more in evidence about the suburbs than they had been for many years previously. The paddocks about Croydon were literally covered with the tubular holes through which the pupæ had escaped, while every tree trunk and fence was festooned with the dry larval skins split down the middle of the back and firmly fixed in position by the powerful claws of the fore legs. For fully three months they kept up one continuous screech, unless a thunder storm sprang up, and then every Cicada was mute. Acting on a suggestion made by Dr. Cox at one of our meetings some time ago [Proceedings iii. (2), p. 1508], I jotted down a number of observations made in the bush under these very favourable circumstances, of which the following notes are the result.

At Croydon the first Cicada was heard on the 30th of October about sunset, and a few days later I caught several of the small black ones (*Melampsalta melanopygia*, Ger.). In February their dead bodies began to be plentiful under the trees, and the calls of the survivors were fitful and irregular, according to the state of the weather, being heard only on fine days. The last heard at

C. F. METCALF

Croydon were calling upon the 14th of March, but a single one was recorded from Rose Bay on the 29th of the same month.

In "Insect Life," [Vol. iv. (1892), p. 248], Riley gives an account of the "digger wasp," *Sphecius speciosus*, which stores its nest with one of the common American Cicadas. As I had heard that wasps had been seen killing Cicadas here, I kept a look out for them. During the height of the "locust season" I frequently saw the large yellow sand wasp, *Priocnemus bicolor*, Smith, hunting over the stems of the trees frequented by the Cicadas, which generally flew away with a great clatter without my being able to see what had happened. Eventually I saw the whole business; a hornet flew up, caught by the leg a Cicada engaged in sucking up sap, and shook it until it withdrew its style and flew away. The hornet then stood over the spot and eagerly sipped up the sap as it exuded from the puncture made by the Cicada's style. I afterwards saw the same performance on several occasions, the hornet apparently never hurting the Cicada.

As a general rule the Cicadas prefer the trunks and stout branches to the young twigs and foliage, for with their long and powerful sucking mouth they can perforate the bark and obtain a plentiful supply of nourishment where the flow of sap is most abundant.

Several accounts have been recently published about the curious miniature cities built by the pupæ of some of the American Cicadas. The pupæ (for some reason as yet unsatisfactorily explained) come up to the surface before they are ready to emerge, and form a hollow dome of clay of from two to four inches in height above their tubular shaft about a foot in depth; to the bottom of this they again retreat, after adding this superstructure, until they are ready to cast their pupal garments.

Very little is known about the habits of the larvæ and pupæ of any of our species, most of them coming straight up from a considerable distance below the surface when ready to emerge; but I have upon several occasions found a single pupa under stones; such were always enclosed in a stout clay cell at the base of which was a small reservoir of water.

I am indebted to Mr. W. F. Kirby, of the British Museum, for the identification of most of my species.

Thopha saccata, Amyot ("The Double Drummer").

This is our largest species, measuring $5\frac{1}{2}$ inches across the wings from tip to tip; the body $9\frac{1}{2}$ lines across the shoulders, and lower down upon the large males at the drums an inch; the abdomen short and rounded in the males, and coming to a sharp point in the females. Wings hyaline and unspotted, the nervures pinkish-brown with the costal lower one marked with black. General colour fulvus-brown, with the centre of the thorax marked with transverse angular black stripes, and the basal part of all the the abdominal segments also black.

From the way in which his musical apparatus projects this Cicada is called the "Double Drummer" by the Sydney boys; and the female without this development is called the "Single Drummer." This species attracts one's notice in the middle of November; and increases in numbers until the middle of January. They were not so common about the gardens, but on North Shore and about Manly seemed to prefer the clumps of small stunted gums (*E. corymbosa*, *E. robusta*, and *E. resinifera*), clinging to the stems, and flying off at the least sound. Their cry is a loud harsh note drawn out and shrill; when singing they do not move their bodies, but droop their wings down on either side.

Cyclochila australasiæ, Amyot ("The Green Monday").

Expanse of wings 5 inches, width across the shoulders 9 lines, length of body 3 inches. Wings hyaline, unspotted; nervures bright green, the base of the large nervures near the shoulder yellow tinted with carmine. The whole of the insect pale grass-green, but changing to a much duller colour after death.

This is our commonest Sydney Cicada, which is found in greater or less numbers every season The first was taken about the 3rd of November, and by the 13th all the trees in the gardens were covered with them; where there were no Eucalypts, they showed a

marked preference for the Pittosporum trees. Though I caught numbers, I could obtain no females until the 24th of November, three weeks after the first males appeared, but after that date they were nearly as plentiful as the other sex.

There is a yellow variety of this species, which is popularly called the "Yellow Monday;" the only difference that I can find is in the colour, but they are nothing like as common as the green one.

♂ Macrouistria angularis, Germ. ("The Union Jack").

Expanse of wings 5 inches, width of shoulders 9 lines, length of body $1\frac{3}{4}$ inches. Wings hyaline, the nervures pale ochreous-yellow, close to the shoulders reddish-brown, the nervures forming the lower marginal cells of the hind wings with a fine pencilled line of black on both sides, giving the wings a slightly mottled appearance. General colour of the insect black, with the front of the head, mesothoracic band, and the apex of the metathorax dark ferruginous; three patches in a line between the eyes with another behind them, a row of three elongate spots in the centre of the prothorax, and a row of four slender transverse spots along the middle of the metathorax pale ochreous-yellow; colour of the ventral surface ferruginous mottled with black; in the males the drums are rather small and do not project on the sides.

This Cicada does not appear about Sydney every year, but during this last season it was comparatively numerous; it is never found about the gardens, but I found it more numerous where the smooth-stemmed gums (*Eucalyptus sieberiana* and *E. hæmastoma*) were common, generally upon the main trunk.

♂ Psaltoda mœrens, Germ. ("The Floury Miller").

Expanse of wings $4\frac{1}{2}$ inches, width of shoulders 8 lines, length of body $1\frac{1}{2}$ inches. Wings hyaline, nervures of the fore wings black, with the edges of several forming a W near the tip of the fore wing, and those forming the apex and sides of the lower row of cells edged on either side with black, giving them a thickened

appearance; the nervures of the hind wings horn-brown, with the apex of the lower row of cells towards the tip deeply shaded with black, fading out towards the middle of the wing.

The whole of the insect is black on the upper surface, but covered with fine silvery white hairs which form little white spots here and there, looking as though it had been dusted with flour. From this circumstance it has received from the Sydney children the rather appropriate name of the "Floury Miller."

None of this species were seen about Sydney until the commencement of December. They are rarely found in gardens, preferring the Eucalypts; at Manly on the 7th of December they were very numerous upon the smooth stems of the apple tree gums (*Angophora lanceolata*); upon one small limb not more than a foot in diameter I counted 49, and all the trees in the gully were covered with them.

When singing they sit close against the stem, elevating the tip of the abdomen and jerking it up and down while the song continues; their note is sharp and shrill, but more musical than any of the other species. When sucking up the sap they flatten the body against the branch, burying the rostrum right up to the head, it being long enough to penetrate the stout bark and reach the inner side. They remained in considerable numbers until early in January, when they began to be scarce.

♀ Psaltoda flavescens, Dist. ("The Mottled Grey").

Expanse of wings 4½ inches, width across the shoulders 7 lines, length of body 16 lines Wings hyaline, nervures brown, but mottled with black, which extends over on either side, forming three irregular bands across the wings, the nervures of the hind wings brown. Ground colour of this Cicada black, thickly mottled with chocolate brown and ferruginous red, the former forming a slender parallel bar across the centre and a band along the apical margin of the prothorax, a W-like mark in the centre, a stripe on the sides of the mesothorax, and the edges of the metathorax and scutellum pale brown, the ferruginous tints

mottling the head and thorax and marbling the segments of the abdomen, the head behind the eyes and the abdomen frosted with silvery pubescence; ventral surface grey except the abdomen which is black, and the covers of the drums which are reddish-pink, flat and placed behind the hind legs

I am told by some of my young friends that this is called the "Mottled Grey," but do not think that the name is in general use. I had never seen more than half-a-dozen specimens of this species until last year, when they appeared in considerable numbers, but chiefly in the neighbourhood of Hurstville and Sutherland; a few were taken about Middle Harbour and others at Granville.

♂ Melampsalta melanopygia, Germ.

Expanse of wings 2 inches, width across the shoulders 3 lines, length of body 10 lines. Wings hyaline, costal nervure of both wings and the two inner nervures of the hind ones yellowish-brown edged with black on both sides, all the others black. Head and thorax chestnut brown mottled with black and clothed with fine white hairs scattered over the dorsal surface, but much closer upon the legs and undersurface; legs chestnut striped with black, the scutellum small, forming four angular star-like ribs, the abdomen at the base and along the summit black, the sides, tip and undersurface golden yellow, lightly clothed with fine hairs.

This is the first Cicada to appear about Sydney, the earliest specimens being taken on the last day of October at Hornsby. They are very active little fellows, flying about and clinging to the stems of the young Eucalypts, calling with a sharp whirring note all the time. I have taken a few of these every season about Hornsby and Middle Harbour, but they do not last long, disappearing in a few weeks.

♂ Melampsalta encaustica, Germ.

Expanse of wing $1\frac{3}{4}$ inches, width across the shoulders 3 lines, length of body 8 lines. Wings slightly opaque, all the larger nervures brown lined on either side with black, all the smaller

ones black. Head and thorax black, with a spot behind the ocelli, a parallel line down the centre of the prothorax, and two similar ones crossing the mesothorax light brown; the ridges of the scutellum of a similar colour but tinged with pink, with several other pink marks above the antennæ and sides of the thorax; abdominal segments black, with a narrow apical transverse band of pale yellow, extending right round, the tip bright yellow; legs variegated with black and white, striped with pinkish-yellow.

This is one of our smallest species, seeming to take the place of the preceding species in the Shoalhaven district.

Three other fine species not yet determined were also taken, but as far as I know are very rare, only a pair of each having been found during the last three seasons.

Tibicina sp. A handsome dark chestnut-brown insect measuring $3\frac{1}{2}$ inches across the wings, with two black spots towards the tips of the forewings, and the sides of the thorax and abdomen clothed with fine white hairs, very thick upon the latter, the costal nervure of the forewings also mottled with similar pubescence.

Psaltoda sp. A large black Cicada with an expanse of 4 inches across the wings, the nervures being tinted with reddish-brown; the male has a large patch of bright golden hairs on the sides of the third segment of the abdomen, absent in the female.

Psaltoda sp. A slightly smaller insect, similar in general colouration, but the blotch upon the side of the abdomen of a bright silvery colour.

ON THE DATES OF PUBLICATION OF THE EARLY VOLUMES OF THE SOCIETY'S PROCEEDINGS.

By J. J. Fletcher.

The first twenty-eight Parts of the Society's Proceedings—constituting Vols. i.-vii. of the First Series (for the years 1875-1882)—offer no more definite indication of the several dates of publication than is afforded by a notice of the year of issue at the foot of the front page of the paper covers, or on the title-page included in the fourth and concluding Part of each Volume. Unless specially instructed to the contrary, bookbinders seem habitually to discard the covers when binding. A number of copies of Vols. i.-iv., bound at Sir W. Macleay's expense, so treated, have passed into circulation under the Society's auspices. In regard to these, and others so dealt with, it should be borne in mind that the year indicated on the title-page is usually that in which the fourth and last Part only of the Volume was issued: or if not so, the coincidence is accidental.

The first twenty-six of the Parts in question were issued prior to the Garden Palace Fire. As the Society's official books and records were completely destroyed therein, no information whatever about these early Parts is forthcoming from this source. Eleven consecutive Parts commencing with Part 2 of Vol. i., were printed by two firms which subsequently retired altogether from business, the establishment of one of them having been completely burnt out; so that no particulars from the publishers are obtainable, and I have only the dates of receipt kindly supplied by the Librarians of the Public Library and Royal Society of N. S. Wales to go by.

Occasionally there arise questions of priority in the description of species dealt with in these Volumes; and requests for authoritative information as to dates of publication are from time to time received.

It seemed advisable, therefore, that the effort should be made, once for all, to ascertain if possible the dates of publication of the first twenty-six Parts with a view to their publication. On applying to the Librarians of the Public Library, Sydney, and the Royal Society of New South Wales, I was most kindly furnished with almost complete lists of the dates of their receipt of the various Parts—which are approximately those of publication. Messrs. F. Cunninghame & Co., who printed Part 1, very obligingly referred to their books, and supplied the requisite information about this Part. Mr. F. White, who printed Vols. iv.-vii., most courteously provided me with a list of the dates of delivery to the Society of the sixteen Parts comprised in these Volumes. From the data so supplied, the list—as approximately correct as it is now possible to make it—given overleaf has been compiled.

One or two other matters may also be noted.

The first Volume is exceptional in that it comprises the Proceedings of two years—Part 1 constitutes the Proceedings for 1875: Parts 2-4 the Proceedings for 1876. In the separate copies of Part 1 as issued, was inserted a slip—which is missing in all the bound Volumes I have seen—setting forth that—

"*The first 20 pages of this Part were printed and circulated ten months ago. They have now been re-printed in order to make the Part complete.*"

The sixteen consecutive Parts, commencing with Vol. viii., and ending with Vol. i. (Second Series), have the dates of issue on the paper covers, but there only. If the covers have not been preserved in binding all clue to dates is lost in bound volumes. They are accordingly included in the list.

Commencing with Vol. ii. (Second Series), not only is the date given on the cover of each Part, but it is repeated at the head of the lists of the Contents of the four Parts comprised in each Volume, supplied along with the title-page and Index in the concluding Part thereof. No room for doubt, therefore, can arise in connection with these and future Parts :—

First Series.

Vol. i.	Part 1 (pp. 1-20 only)—	Issued April 27th	1875.
	1 (pp. 1-96)	,, *February	1876.
	2 (pp. 97-168)	,, *July	1876.
	3 (pp. 169-282)	,, *February	1877.
	4 (pp. 283-419)	,, *March	1877.
Vol. ii.	Part 1 (pp. 1-122)	,, *July	1877.
	2 (pp. 123-217)	,, *January	1878.
	3 (pp. 218-288)	,, *May	1878.
	4 (pp. 289-401)	,, *June	1878.
Vol. iii.	Part 1 (pp. 1-76)	,, *September	1878.
	2 (pp. 77-161)	,, *December	1878.
	3 (pp. 161-305)	[No data]	
	4 (pp. 306-443)	,, *May	1879.
Vol. iv.	Part 1 (pp. 1-116)	,, June 16th	1879.
	2 (pp. 117-244)	,, October 6th	1879.
	3 (pp. 245-387)	,, December 1st	1879.
	4 (pp. 387-492)	,, May	1880.
Vol. v.	Part 1 (pp. 1-105)	,, August	1880.
	2 (pp. 106-272)	,, November 22nd	1880.
	3 (pp. 272-458)	,, February	1881.
	4 (pp. 459-652)	,, May 20th	1881.
Vol. vi.	Part 1 (pp. 1-170)	,, July	1881.
	2 (pp. 170-408)	,, September 12th	1881.
	3 (pp. 409-711)	,, December	1881.
	4 (pp. 712-872)	,, March 20th	1882.
Vol. vii.	Part 1 (pp. 1-135)	,, May 23rd	1882.
	2 (pp. 135-304)	,, August	1882.
	3 (pp. 303-404)	,, October 28th	1882.
	4 (pp. 405-684)	,, April	1883.

* Dates of receipt, or more correctly, dates of registration. As at this time the publications do not seem to have been always delivered as punctually as they are now, it is not improbable that some of the dates given are really as much as one month or even longer behind time.

Vol. viii. Part 1 (pp. 1-180)	—Issued	June 19th	1883.
2 (pp. 181-298)	„	July 17th	1883.
3 (pp. 299-417)	„	October 19th	1883.
4 (pp. 419-583)	„	February 21st	1884.
Vol. ix. Part 1 (pp. 1-181)	„	May 23rd	1884.
2 (pp. 183-443)	„	August 19th	1884.
3 (pp. 445-866)	„	November 29th	1884.
4 (pp. 867-1242)	„	March 4th	1885.
Vol. x. Part 1 (pp. 1-126)	„	June 4th	1885.
2 (pp. 127-279)	„	July 31st	1885.
3 (pp. 279-554)	„	December 21st	1885.
4 (pp. 555-881)	„	April 3rd	1886.

Second Series.

Vol. i. Part 1 (pp. 1-238)	—Issued	May 25th	1886.
2 (pp. 239-578)	„	August 23rd	1886.
3 (pp. 579-975)	„	November 17th	1886.
4 (pp. 975-1237)	„	February 22nd	1887.

DESCRIPTION OF A TREE CREEPER PRESUMABLY NEW.

By C. W. De Vis, M.A., Corr. Mem.

Unknown to the author, the same species had been shortly before described by Mr. North in the *Ibis* (July, 1895). The paper was therefore withdrawn.

NOTES AND EXHIBITS.

The President exhibited a number of botanical specimens from the Tweed River, including fruiting examples of *Elæocarpus grandis*, F.v.M., locally known as the Blue Fig or Quandong, an interesting slender variety of *Pteris tremula*, *Aspidium tenerum*, *Adiantum æthiopicum*, and other ferns at present undetermined. Also *Gleichenia dichotoma*, Hk., from the Hawkesbury River; cones of *Sequoia gigantea;* and an undetermined *Banksia* which needs investigation.

Mr. Froggatt exhibited his collection of Sydney Cicadas.

Mr. Steel showed a Gecko *(Gehyra vorax*, Gir.) from the Rewa River, Fiji. He also remarked that the animal when alive is extremely flaccid, as if it had no bones; it is also apparently to some extent vegetarian in its diet, portions of leaves of the sugar cane as well as of an undetermined plant having been found in the stomach of a specimen dissected.

Mr. Fletcher showed some English humble bees, the defunct portion of a consignment from New Zealand recently brought over by the Department of Agriculture in the hope of the successful acclimatisation of the insects. Of the survivors some were liberated in the Botanic Gardens, and some in the Society's garden. As the bees were set free just after the first of the recent rains, they should have a fair chance of doing well; and any information about their subsequent movements and operations would be welcome.

WEDNESDAY, OCTOBER 30TH, 1895.

The Ordinary Monthly Meeting of the Society was held at the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, October 30th, 1895.

The President, Mr. Henry Deane, M.A., M.I.C.E., in the Chair.

Miss Mary Lodder, Ulverston, Tasmania, was elected an Associate Member of the Society.

DONATIONS.

Geological Survey of India—Records. Vol. xxviii. Part 3 (1895). *From the Director.*

Six Pamphlets on Hymenoptera. By M. C. Janet. *From the Author.*

Pharmaceutical Journal of Australasia. Vol. viii. Nos. 9-10 (Sept.-Oct., 1895). *From the Editor.*

Pamphlet entitled "Phthisis in New South Wales and other Australasian Colonies." By G. L. Mullins, M.A., M.D. *From the Author.*

Bureau of Agriculture, Perth, W.A.—Journal. Vol. ii. Nos. 20-21 (Sept.-Oct., 1895). *From the Secretary.*

Zoological Society of London—Proceedings, 1895, Part ii. *From the Society.*

Perak Government Gazette. Vol. viii. Nos. 22-23 (Aug.-Sept.). *From the Government Secretary.*

Royal Microsopical Society—Journal, 1895. Part 4 (Aug.). *From the Society.*

Société des Sciences de Finlande—Acta. T. xx. (1895): Bidrag till Kännedom af Finlands Natur och Folk. 54-56 Häftet: Oefversigt. T. xxxvi. (1893-94). *From the Society.*

Société d'Horticulture du Doubs, Besançon—Bulletin. n.s. No. 56 (Aug., 1895). *From the Society.*

Zoologischer Anzeiger. xviii. Jahrg. Nos. 483-484 (Sept., 1895). *From the Editor.*

K. K. Zoologisch-botanische Gesellschaft in Wien—Verhandlungen. Bd. xlv., Heft 7 (1895). *From the Society.*

Manchester Museum, Owens College—Studies from the Biological Laboratories. Vols. i.-ii. (1886-90): Catalogue of the Library (1895): Handy Guide to the Museum (1895): Report, 1890-94. *From the Museum.*

Victorian Naturalist. Vol. xii. No. 6 (Sept., 1895). *From the Field Naturalists' Club of Victoria.*

American Naturalist. Vol. xxix. No. 345 (Sept., 1895). *From the Editors.*

Pamphlet entitled "Remarks on *Daimonelix*," &c. (From the American Geologist. xv.) By J. F. James, M.Sc. *From the Author.*

U.S. Department of Agriculture—Division of Entomology—Insect Life. Vol. vii. No. 5 (1895): Technical Series. No. 1. "*Aphelininæ* of N. America." *From the Secretary of Agriculture.*

American Museum of Nat. Hist.—Bulletin. Vol. vii. (1895). Sig. 17 (pp. 257-272). *From the Museum.*

Department of Mines, Sydney—Memoirs. Palæontology, No. 9 (1895). *From the Hon. the Minister for Mines.*

Marine Biological Association, Plymouth—Journal. n.s. Vol. iii. No. 5 (Extra No.): Vol. iv. No. 1 (Sept., 1895). *From the Director.*

Revista de Sciencias Naturaes e Sociaes. Vol. iv. No. 13 (1895). *From the Editor.*

Science Gossip. 58 Nos. (1890-95): British Naturalist. 23 Nos.: Phipson's "Phosphorescence": Catalogue of the Library of the Linnean Society. Parts i.-iii.: and Thirty-three Miscellaneous Pamphlets. *From C. T. Musson, Esq., F.L.S.*

Linnean Society of London—Transactions. Second Series. Botany. Vol. iv. Part 2; Vol. v. Part 1 (1894-95); Zoology. Vol. vi. Part 3 (1894). *From C. Hedley, Esq., F.L.S.*

"Spelunca" (Bulletin de la Société de Spéléologie). T. 1er. No. 1 (Jan.-Mar., 1895): Extrait de L'Annuaire Géologique Universal—Asie et Océanie. Pamphlet entitled "Etude de Géologie sur le Bassin de Paris" (1894). Par G. Ramond. *From Monsieur G. Ramond.*

Department of Agriculture, Brisbane—Botany Bulletin, No. xii (Oct., 1895). *From the Government Botanist.*

Department of Agriculture, Sydney—Agricultural Gazette. Vol. vi. Part 9 (Sept., 1895) *From the Hon. the Minister for Agriculture.*

Australasian Journal of Pharmacy. Vol. x. No. 118 (Oct., 1895). *From the Editor.*

THE GREY GUM OF THE NORTH COAST DISTRICTS.

(*Eucalpytus propinqua*, sp.nov.)

By Henry Deane, M.A., F.L.S., and J. H. Maiden, F.L.S.

(Plate xliii.)

The Grey Gum of the North Coast districts has for many years held an uncertain botanical position, having being ranked at different times by botanists under *E. punctata*, *E. saligna*, and even *E. viminalis*. We determined to carefully investigate the tree *de novo*, and we have arrived at the opinion that it will but perpetuate the confusion which has for so many years existed, if it be subordinated to any existing species. From observations in the field and upon dried specimens, we find that it is remarkably constant, and in raising it to specific rank under the name of *Eucalyptus propinqua*, we allude to its affinities with *E. punctata* and *E. saligna*.

The species also bears considerable affinity to *E. resinifera*, not only in regard to the fruits, which are so similar as to be distinguished with difficulty from some of the smaller forms of *E. resinifera*, but also in leaf-venation.

Eucalyptus propinqua, sp.nov.

A large, straight growing, cylindrical-stemmed tree, found up to 4 or 5 feet in diameter, and 120 feet and more in height.

Bark.—It has a grey dusty-looking slightly raspy appearance as regards its bark. Next to the Blue or Flooded Gum it is one of the straightest stemmed trees in the forest. The bark darkens, peels off in large longitudinal irregular patches, leaving a smooth white surface, which in course of time darkens, peels off, and the

process is indefinitely repeated. The bark closely resembles, and is perhaps not to be distinguished from, that of *E. punctata.*

Timber.—Dark coloured, and so closely resembling Red Ironbark *(E. siderophloia)* that care is required to distinguish the two timbers. Inclined to have rings or "scabs" of kino, which diminishes the demand for it for sawn stuff. Very durable in or out of the ground, but its tensile strength inferior to that of the Ironbark already referred to.

Seedling leaves.—More broadly lanceolate, and with the marginal vein more distant from the edge, than in the case of the mature leaves. At first opposite.

Mature leaves.—Narrow lanceolate and very uniform. Average length 4-5 inches, breadth $\frac{3}{4}$ inch. Veins not prominent, lateral veins nearly parallel; marginal vein on or very close to the edge of the leaf as a very general rule. Edge usually slightly recurved.

Peduncles flattened.

Calyx-tube hemispherical, and longer than the operculum. Sometimes with the angles of the flattened pedicel decurrent.

Flowers in a marked manner pedicellate; usually in tens, but the umbels containing as few as five flowers.

Operculum hemispherical in general outline, but with a low pointed apex.

Stamens inflexed before expansion, the anthers opening by parallel slits, and all fertile.

Fruit very uniform in size, about $2\frac{1}{2}$ lines broad by $1\frac{1}{2}$ lines deep. Usually 4-celled. Occasionally 3-celled; 5-celled not seen at present. The rim usually shows two sharp edges, with the intervening space concave. The *valves* are well exserted.

The fruits, as regards the rim and general contour, considerably resemble those of the smaller forms of *E. resinifera,* more so than those of *E. punctata.*

Affinities.—The affinities of *E. propinqua* are with *E. saligna* and *E. punctata,* contiguous species in Baron von Mueller's *Census.*

A paper by J. H. Maiden and R. T. Baker in Proc. Linn. Soc. N.S.W. [2], viii., 312, may be here referred to, as the affinity of *E. propinqua* to *E. saligna* is there shown. *E. propinqua* is, in that paper, looked upon as a variety of *E. saligna*.

As regards *E. punctata* and *E. propinqua*, the timber and bark of the two species resemble each other a good deal; they may be, for all practical purposes, identical. They also agree in the flattened peduncles and the stamens (points of resemblance, however, not peculiar to these two species).

Differences.—They differ in the size of the flower-buds and fruits, which in *E. propinqua* are quite small; *E. propinqua* has narrow lanceolate leaves and also has more parallel and less prominent lateral veins than *E. punctata*. The calyx-tube and also the operculum of *E. propinqua* are more distinctly hemispherical and its flowers more pedicellate.

The fruit of *E. punctata*, though variable in size, is always larger and more cylindrical than that of *E. propinqua*.

We are fully aware that *E. punctata*, as at present defined, is a somewhat unsatisfactory species, and it is our intention to fully deal with the matter, in its proper order, in the series of Notes on New South Wales Eucalypts which we will shortly commence to submit to the Society.

Range.—From the Hawkesbury River northwards at least as far as the Tweed River. We have no evidence yet as to whether it extends to Queensland, but it very probably does. Going west it has been found on the eastern slopes of the Dividing Range.

EXPLANATION OF PLATE.

Fig. 1.—Two twigs, showing variation in width of leaves.
Fig. 2.—Part of a leaf, showing venation, and also slight recurving of edge.
Fig. 3.—Vertical section of a bud.
Fig. 4.— ,, ,, of an expanded flower.
Fig. 5.—Front and back view of anther.
Fig. 6.—Individual fruits.

JOTTINGS FROM THE BIOLOGICAL LABORATORY OF SYDNEY UNIVERSITY.

By Prof. William A. Haswell, M.A., D.Sc.

No. 18.—Note on Certain Points in the Arrangement and Structure of the Tentaculiferous Lobes in *Nautilus pompilius*.

(Plate xlviii.)

In writing a short account of the structure of Nautilus for a general work I have had occasion to examine a considerable number of specimens, and in doing so have noticed one or two points to which attention has, I think, not hitherto been directed. The most important of these, with which alone the present communication deals, has to do with the tentaculiferous lobes of the foot, and their sexual modifications.

No fewer than three papers published or read recently deal with sexual differences in Nautilus. Two of these, one by Willey,* the other by Vayssière,† refer only to sexual differences in the shell; the third, by J. Graham Kerr,‡ is referred to below.

The tentacles of Nautilus are arranged in two series—an outer, and an inner. With the outer series we are not at present concerned. The inner series exhibit a marked sexual difference in their arrangement. In the female this inner series consists of two symmetrical lateral lobes, each bearing twelve tentacles, and of a median (posterior) portion. In the male the two lateral lobes of the inner series are unsymmetrically developed, four of the tentacles of one side, usually the left, being modified to form the structure known as the spadix.

The spadix was first described by Van der Hoeven.§ He calls it "a great conoid body, the length of which was nearly $2\frac{1}{2}$

* Natural Science, June, 1895.

† Comptes Rendus, 24th June, 1895.

‡ Zoological Society of London, Abstract of Proceedings, June 18, 1895.

§ Trans. Zool. Soc., Vol. iv., p 27. The earlier Dutch papers are not accessible to me.

inches; this part was laterally compressed; at its basis its measure from the dorsal to the ventral side was found to be 1 inch, 10 lines; from the right to the left side only 1 inch." He adds "This part was proved to me by dissecting it to be formed by the union of four unusually developed tentacular slips, one of which was shorter and more free, the three other chiefly composing the singular body."

From the dimensions here given and the figures accompanying the paper it would appear that Van der Hoeven had under observation a completely or nearly completely developed specimen. Such mature specimens are comparatively rare; and all the male Nautili that have been made the subjects of other published descriptions appear to have been immature, so that some important and interesting points in the structure of the fully-developed spadix have been overlooked.

In the larger of the two mature male specimens I have had the opportunity of examining (in which the greatest diameter of the shell is $6\frac{1}{2}$ inches) the total length of the organ is $3\frac{1}{4}$ inches, the greatest breadth about $1\frac{1}{3}$ inch, and the thickness a little less than an inch. The four tentacles composing it (Plate xlviii. fig. 1) are all very strongly modified in different directions. One of them, as observed by Van der Hoeven, is separate from the rest except at the base. It is shorter than the others, and does not seem to be capable of being retracted, its sheath being very short: its free part, which is spathulate towards the extremity, lies under shelter of a wide fold extending backwards over it from the sheath of the tentacle which I have numbered 3. Tentacles 2, 3, and 4 have their sheaths united, but the tentacles themselves are quite separate. No. 2 is a thick, solid, muscular cylinder, or rather elongated, blunt cone, probably not capable of being extended to any great distance; the cavity of its sheath is very wide. No. 3 is elongated and laterally compressed, marked on its posterior and external surface with numerous transverse ridges. No. 4 presents the most remarkable modification; it is thick and cylindrical towards the base, becoming compressed towards the free end. The outer

surface (fig. 2) has the appearance of a minute honeycomb, owing to its being covered over with numerous rows of minute apertures, arranged with the greatest regularity.

On the free flap of the 3rd tentacle covering over the 1st, there is to be observed an oval dark patch, which to the naked eye appears minutely tuberculated. When this is examined under a lens (fig. 3) the tubercles are found to be minute elevations, each with a rounded aperture at its summit. Microscopic sections shew the thickened patch to contain numerous branching glands, the ducts of which open at the apertures mentioned. The specimens were not in good order for histological study; but the cells of the glands were found to be full of large rounded granules.

The remaining portion of the inner series (internal labial tentacles of Owen,* labial tentacular lobe of Keferstein†) is fully developed only in the female. It consists of a large flattened median lobe, situated posteriorly in immediate contact with the buccal mass. It is divided by a deep median notch into two parts, each of which bears fourteen tentacles. On the middle of its inner surface is an oval patch where the integument is raised up into numerous closely set ridges, which are in series with the tentacles, the most external ridges and the most internal tentacles being scarcely distinguishable from one another. This ridged body is referred to by Owen‡ as probably having an olfactory function, and a similar view is expressed by Ray Lankester.§ Van der Hoeven‖ dissents from this and expresses the belief that these folds are "only rudimentary digitations completing the circle of the internal labial processes."

It seems somewhat remarkable that a connection of some kind with the function of reproduction should not earlier have been suggested for the entire inner tentaculiferous lobe with its

* Memoir on the Pearly Nautilus, 1832.

† Bronn's Thierreich, Malacozoa, III. Band, p. 1360.

‡ *Op. cit.*

§ Zool. Articles from the Encyclopædia Britannica, Mollusca, p. 137.

‖ Trans. Zool. Soc. iv.

tentacles and ridged organ. Its possession is quite as characteristic a feature of the female as the presence of the spadix is of the male. In the male its only representative is a bi-lobed folded body, termed by Van der Hoeven "cushion-shaped incised bodies."

Graham Kerr has apparently suggested such a connection for the ridged organ, as will appear from the following quotation from the abstract already referred to—"The curious laminated organ ventral to the buccal mass in the female, which had been believed to be olfactory, was pointed out as probably having some connection with reproduction — apparently being a glandular apparatus to which the spermatophore of the male becomes attached." That the organ has some such function seems to me extremely probable. In the Dibranchiate Cephalopods the hectocotylised arm is so long that it can readily be used as an intromittent organ for depositing the spermatophores in the mantle-cavity of the female. In the Nautilus, however, such intromission is impossible, and there must be some indirect mode of transmission of the spermatophores. It seems very probable that the whole inner part of the foot of the female is connected with this function, grasping the spadix and receiving the sperms from the cavities on its honey-combed tentacle. The presence in the wall of the mantle-cavity of the female of a pair of glands which appear to correspond to the nidamental glands of the Dibranchiata, would seem to render it probable that the ova must be fertilized in the mantle-cavity. The function of the laminated area, present only in the female, on the inner surface of the outer tentaculiferous lobe may, perhaps, be to form a brood-pouch for the developing ova. Such a function might be suggested for the inner lobe, were it not that the latter is in close contact with the buccal mass, and thus must be subject to frequent changes of position.

One of the six or eight female specimens examined by me presents a condition of the median inner tentaculiferous lobe, which may, perhaps, have a bearing on the functions of the part. In this specimen, which was a good-sized one and fully developed in

other respects, the lobe in question was represented by a rudiment (fig. 4), in which, however, all the parts of the perfected structure were distinctly and symmetrically represented. The condition of this single specimen does not afford sufficient grounds for attempting to make any deductions, but I direct attention to it here, as the examination of further material might establish this as a modification of regular occurrence, and, therefore, requiring to be taken into account in any attempt to explain the uses of the various tentaculiferous lobes.

EXPLANATION OF PLATE.

Fig. 1.—Spadix of mature *Nautilus pompilius* from the outer side (natural size) 1, 2, 3, 4 tentacles, *gld.*, glandular patch.

Fig. 2.—Portion of surface of tentacle 4, magnified.

Fig. 3.—Portion of the surface of glandular patch, magnified.

Fig. 4.—Inner tentaculiferous lobes of specimen referred to in the text.

ON THE OCCURRENCE OF DIATOMACEOUS EARTH AT THE WARRUMBUNGLE MOUNTAINS, N.S.W.

By Professor T. W. Edgeworth David, B.A., F.G.S.

(Publication deferred for the present.)

NOTES AND EXHIBITS.

Mr. Froggatt exhibited specimens of two species of Scale Insects and parasites bred therefrom; with the following Note:—"About Sydney *Icerya purchasi* is not a common coccid, seldom being found in more than twos or threes upon the small branches, chiefly of *Acacia discolor*, in the bush. This year my colleague Mr. H. G. Smith had a young tree of *Acacia baileyana* in his garden at Tempe covered with this scale, and he brought me a large spray swarming with adult females, which I enclosed in a box. From these I bred some hundreds of small chalcid parasites (*Euryischia lestophoni*, Riley), and also a number of dipterous parasites (*Cryptochaeton iceryæ*, Willist.). At my request, Mr. Smith observed the coccids *in situ*, and he soon found them falling off; and before very long they were all dead. No lady birds (*Coccinellidæ*) or their larvæ were seen upon the tree, which was cleared of the pest by the minute parasites above mentioned; and it seems evident that in this part of Australia we owe much more to these parasites than to their coleopterous enemies for our immunity from the cottony cushion or fluted scale insects as serious pests. The Floridian scale (*Icerya roseæ*, Riley and Howard) has been very plentiful upon the foliage of the Grevilleas and Hakeas on the Illawarra line, and from them I have bred the same species of dipterous parasite, and numbers of the secondary parasite, a chalcid that is parasitic upon the fly larvæ *Ophelosia crawfordi*, Riley, and is therefore not an enemy of the scale insects."

Mr. Waite sent for exhibition a specimen of *Peripatus leuckartii*, Säng., from Colo Vale, near Mittagong, and recorded localities for other specimens, including some collected by Mr. C. J. McMasters at Moree. As *Peripatus* has been supposed hitherto to be confined to the table-land and coastal districts, its occurrence so far inland as Moree is particularly noteworthy.

Professor David exhibited mounted and bulk specimens of diatomaceous earth, sanidine tuff, trachyte, and trachyte ash

containing leaves of *Cinnamomum Leichhardtii*, Ett., all from the Warrumbungle Mts.

Mr. Steel exhibited (1) a nodule popularly but erroneously supposed to be of meteoric origin, from the MacDonnell Ranges: (2) a large Crustacean *(Ibacus peronii)* caught at Pyrmont: and (3) a specimen of growing sugar cane forwarded from the Clarence River by Mr. W. J. Freeman, attacked by Termites; the soft interior of the cane was scooped out, and then filled with a brown deposit; the results of a chemical analysis of the latter were submitted for comparison with those of an analysis of a fresh sample of the deposit from an ordinary Termite nest.

Mr. North called attention to the numbers of dead specimens of Mutton Birds *(Nectris brevicaudus)*, near Sydney, washed up on the beaches during the past fortnight, and to which reference had been made in recent issues of the "Sydney Morning Herald" by Mr. Cavendish Liardet and Mr. Woolcot-Waley. In company with the former gentleman Mr. North visited the beach at Bondi on the 30th inst., and found hundreds of the bodies of these birds. Several fresh specimens were collected in the hope that an examination would throw some light on the cause of the unusual mortality in this species. Usually it is a rare bird in New South Wales waters, and just now has probably been driven from the south, where it is abundant, by severe gales. Mr. Brazier had recorded at a meeting of this Society in December, 1880, a similar instance of mortality among several species of sea birds (Proceedings, Vol. V., p. 637).

WEDNESDAY, NOVEMBER 27TH, 1895.

The last Ordinary Monthly Meeting of the Society for the current Session was held at the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, November 27th, 1895.

The President, Mr. Henry Deane, M.A., M.I.C.E., in the Chair.

The President announced the deaths of Professor Sven Ludvig Lovén, the veteran Swedish naturalist, an Honorary Member, and Mr. J. Bracebridge Wilson, M.A., of Geelong, an Ordinary Member.

DONATIONS.

Entomological Society of London—Transactions, 1895. Part iii. *From the Society.*

Royal University of Upsala—Meddelanden från Mineralogisk-Geologiska Institution. Nos. 14-15. *From the University.*

Bureau of Agriculture, Perth, W.A.—Journal. Vol. ii. Nos. 22-24 (Oct.-Nov., 1895). *From the Secretary.*

Bombay Natural History Society—Journal. Vol. ix. No. 3 (March, 1895). *From the Society.*

Perak Government Gazette. Vol. viii. Nos. 24-26 (Sept.-Oct., 1895). *From the Government Secretary.*

Société d'Horticulture du Doubs—Bulletin. n.s. No. 57 (Sept., 1895). *From the Society.*

Société Hollandaise des Sciences à Harlem—Archives Néerlandaises. T. xxix., 3me Liv. (1895). *From the Society.*

Geological Survey of New South Wales—Records. Vol. iv. Part iv. (1895). *From the Hon. the Minister for Mines.*

Royal Society of Canada—Proceedings and Transactions for the year 1894. Vol. xii. *From the Society.*

Geelong Field Naturalists' Club—The Geelong Naturalist. Vol. v. No. 1 (Oct., 1895). *From the Club.*

Department of Agriculture, Sydney—Notes on the Commercial Timbers of New South Wales. By J. H. Maiden, F.L.S. *From the Department.*

Pamphlet entitled "Census of Plants of the Cape Otway Forest." By G. H. Adcock, F.L.S. *From the Author.*

Zoologischer Anzeiger. xviii. Jahrg. Nos. 485-486 (Sept.-Oct., 1895). *From the Editor.*

Société Royale des Sciences de Liége—Mémoires. 2me Ser. T. xviii. (July, 1895). *From the Society.*

Report on Northern Territory Explorations, 1895. By H. Y. L. Brown, Government Geologist, South Australia. *From the Author.*

Comité Géologique, St. Pétersbourg—Mémoires. Vol. x. No. 3 (1895); Vol. ix. No. 4; Vol. xiv. No. 3: Bulletins. Vol. xiii. Nos. 8-9; Vol. xiv. Nos. 1-5 (1895). *From the Committee.*

Harvard College, Cambridge, Mass.—Bulletin of the Museum of Comparative Zoology. Vol. xxvi. No. 1; Vol. xxvii. Nos. 2-3 (1895). *From the Curator.*

American Naturalist. Vol. xxix. No. 346 (Oct., 1895). *From the Editors.*

Société Impériale des Naturalistes de Moscou—Bulletin. Année, 1895. No. 2. *From the Society.*

American Museum of Nat. Hist., New York—Bulletin. Vol. vi. (1894); Vol. vii. Sig. 18-19 (pp. 273-304): Annual Report for the Year 1894. *From the Museum.*

Department of Agriculture, Sydney—Agricultural Gazette. Vol. vi. Part 10 (Oct., 1895). *From the Hon. the Minister for Mines and Agriculture.*

Victorian Naturalist. Vol. xii. No. 7 (Oct., 1895). *From the Field Naturalists' Club of Victoria.*

Conchological Society of Great Britain and Ireland—The Journal of Conchology. Vol. viii. No. 4 (Oct., 1895). *From the Society.*

Société Royale Linnéenne de Bruxelles—Bulletin. 20me Année, No. 9 (Aug.-Sept., 1895). *From the Society.*

Muséum d'Histoire Naturelle, Paris—Bulletin. Année, 1895. No. 6. *From the Museum.*

Australasian Journal of Pharmacy. Vol. x. No. 119. (Nov., 1895). *From the Editor.*

Bureau of American Ethnology—Eleventh and Twelfth Annual Reports (1889-91): Contributions to North American Ethnology. Vol. ix. (1893): Bulletins T.-V. and X. (Nos. 20-22 and 23 [1894]). *From the Bureau.*

U.S. Department of Agriculture: Division of Ornithology and Mammalogy—North American Fauna. No. 8 (1895). *From the Secretary of Agriculture.*

California Academy of Sciences—Memoirs. Vol. ii. No. 4 (March, 1895): Proceedings (Second Ser.). Vol. iv. Part 2 (April, 1895). *From the Academy.*

Cincinnati Society of Nat. Hist.—Journal. Vol. xvii. No. 4 (Jan., 1895). *From the Society.*

Denison University—Bulletin of the Scientific Laboratories. Vol. viii. Parts i.-ii. (May, 1893—June, 1894). *From the University.*

Academy of Natural Sciences, Philadelphia—Proceedings, 1894. Part iii. (Oct.-Dec.): 1895, Part i. (Jan.-Mar.). *From the Academy.*

American Philosophical Society—Proceedings. Vol. xxxii. (No. 143: May, 1893). Vol. xxxiii. Part 3 (No. 146: July-Dec., 1894). *From the Society.*

Missouri Botanical Garden—Sixth Annual Report (1895). *From the Director.*

New York Academy of Sciences—Annals. Index, &c., to Vol. v. (1891): Index, &c., to Vol. vii. (1895): Vol. viii. No. 5 (Feb., 1895). *From the Academy.*

Wagner Free Institute of Science, Philadelphia—Transactions. Vol. iii. Part 3 (March, 1895). *From the Institute.*

Gesellschaft für Erdkunde zu Berlin—Zeitschrift. Bd. xxix. (1894) No. 6; Bd. xxx. (1895) No. 1: Verhandlungen. Bd. xxi. (1894) No. 10; Bd. xxii. (1895) Nos. 1, 2, 3. *From the Society.*

K. K. Zoologisch-botanische Gesellschaft in Wien—Verhandlungen. xliv. Bd. iii.-iv. Quartal (1894). *From the Society.*

K. K. Naturhistorisches Hofmuseum, Wien—Annalen. Bd. ix. Nr. 3-4 (1894). *From the Director.*

L'Académie Impériale des Sciences de St. Pétersbourg—Mémoires. vii Série. T. xlii. No. 12 (1894). *From the Academy.*

Kaiserliche Leopoldino-Carolinische Deutsche Akademie der Naturforscher—Leopoldina. xxviii.-xxx. Hefte (1892-94): Nova Acta. Bd. lix. Nr. 1-2; Bd. lx. Nr. 2; Bd. lxi. Nr. 5; Bd. lxiv. Nr. 2 (1893-94). *From the Academy.*

ON SOME DEVELOPMENTS OF THE MAMMALIAN PRENASAL CARTILAGE.

By R. Broom, M.D., C.M., B.Sc.

(Plate xliv.)

The prenasal element has been shown by Kitchen Parker* to be a median cartilaginous development found in the anterior part of the head and arising in connection with the front part of the cranial trabeculæ. Though this element is represented in all the groups from the Elasmobranchs to Mammals, in the majority of forms it is either rudimentary or only found in the young, and in the adult it rarely attains any great degree of development.

In the Elasmobranchs the prenasal cartilage is a well-developed structure, and forms the axis of the large rostrum in the Skate and other fishes. The rudimentary prenasal found in most higher forms is probably an inheritance from these cartilaginous fishes.

In the bony fishes with the development of the premaxillary bones an agent was provided which served the double purpose of cutting the water and of giving a firm support for the teeth, and the need for the prenasal being thus gone we find it reduced to a mere rudiment.

The premaxillary bones in almost all the higher forms with their important tooth-bearing function prevent the development of the prenasal cartilage, which though sometimes an element of importance in the very young animal, in most cases becomes obliterated by the developing premaxillaries.

In birds the prenasal forms the framework of the beak in the early embryo, but as development advances it gradually becomes encroached upon by the premaxillaries on either side. In the

* W. K. Parker. Various Monographs on Development of the Skull, Phil. Trans.

skull of an embryo chick of the middle of the second week as figured by Parker,* the prenasal is seen as a well-developed median cartilage, passing to the front of the beak and separating the two premaxillaries from each other. In the chick two days old the premaxillaries have united and quite obliterated the prenasal in front, reducing it to a small median spur extending in front of the nasal septum and lying on the palatal surface of the hinder part of the united premaxillaries. In the old bird the cartilage has quite disappeared.

In the mammalia where the premaxillaries are generally well developed to support the incisor teeth, the prenasal cartilage is, as might be supposed, usually rudimentary or absent. There is moreover in most mammals another peculiarity unfavourable to the existence of the prenasal—the union of the prevomer with the premaxillary. As I have recently shown,† the mammalian prevomer, though occasionally a distinct element *(Ornithorhynchus, Miniopterus)*, usually early anchyloses with the premaxillary or becomes ossified in connection with it. As this structure lies below the nasal septum, in being connected anteriorly with the premaxillary, the anterior palatal region becomes to a large extent shut off from the nasal septum, and in the adult condition where the bones are closely articulated in the middle line completely so. In a few interesting instances, however, the prenasal element has succeeded in asserting itself.

The most remarkable developments of the prenasal are in the egg-laying mammals—*Ornithorhynchus* and *Echidna*. The premaxillaries in both these forms are edentulous and feebly developed, and in neither are they provided with palatine processes, as in *Ornithorhynchus* the prevomer is distinct and in *Echidna* quite absent.

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* W. K. Parker. On the Structure and Development of the Skull of the Common Fowl. Phil. Trans. 1869, p. 755.

† R. Broom. "On the Homology of the Palatine Process of the Mammalian Premaxillary." Proc. Linn. Soc. N.S.W. (2nd Ser.) Vol. x. 1895.

In a recent paper* Wilson and Martin have carefully described some of the chief points in the anatomy of the muzzle of *Ornithorhynchus*. They have dealt principally with the structure and relations of the large rostral cartilage. By a series of transverse vertical sections the authors show that the nasal septum on passing forward divides into a slender upper and a well developed lower part, and that this latter being continued forward, broadens out and becomes the rostral cartilage. For a short distance the rostral cartilage is shown to be clasped between the premaxillaries, recalling the condition of the embryonic bird. From this relationship and from the fact of its being a continuation of the nasal septum, the rostral cartilage is held to be an enormously developed prenasal. With their view I must express my entire agreement. While my researches confirm the accuracy of the sections figured by Wilson and Martin, they reveal an interesting point apparently not observed by these authors. The rostral cartilage does not extend forward to the front of the beak as an entire sheet. Almost immediately in front of the plane passing through the anterior parts of the premaxillaries the cartilage becomes abruptly arrested in the middle line; but while this is so, the lateral parts extend forward almost to the front of the beak, where they again approach each other, meeting, or almost so, in the middle line. There is thus left in the middle an oval space entirely free from cartilage. This arrangement I have found in three different individuals (two males and one female). The lateral portions of the cartilage curve round backwards along the outer sides of the rostral crura, supporting the lip as shown by Wilson and Martin. It seems probable that this whole complicated marginal cartilage is a development of the prenasal, for though in the Skate the prenasal rostrum supports a pair of labials at its anterior part, in the higher forms when labial cartilages are present they never seem to have the same relations to the premaxillaries as is found in the Platypus.

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* J. T. Wilson and C. J. Martin. "Observations upon the Anatomy of the Muzzle of *Ornithorhynchus*." Macleay Memorial Volume, Linn. Soc. N.S.W. 1893.

In fig. 1, Pl. xliv., is represented a longitudinal median section of the snout of *Ornithorhynchus* which shows the relations of the cartilages. The nasal septum proper (*n.s.*) is seen in front to divide into the upper delicate cartilaginous process (*a.n.s.*) and the lower well developed prenasal (*p.n.*). The upper process passes between the anterior nares, whose position is indicated by the dotted lines (*a.n.*), and is probably the homologue of the anterior part of the nasal septum in the higher mammals, as to it are attached, in its hinder part at least, the alinasals. Though in the region of the anterior nares it is considerably removed from the prenasal plate, on passing forward it approaches the latter, and ends in close connection with it, at the point where the prenasal becomes arrested in the middle line. This point (marked *) probably represents the anterior end of the beak in the ancestor of the Platypus, as not only do the two cartilages here end together, but this is practically where the two premaxillaries would meet if they came together. Connected with it, moreover, there is a further feature of importance. On the upper side of the beak in the middle line is a small area of thickened epithelium (*c*) unlike that of the rest of the beak. This is probably the remains of the caruncle. If it be so, and it is quite perceptible externally in the fresh specimen even to the naked eye, it corrects the statement of Owen's* that no trace of the caruncle can be found in the adult. Whatever be its signification, it is evidently closely related to the supposed apical point of the primitive beak, as a series of fibrous bands pass from it to the latter.

In the anterior part of the section is seen the anterior union of the incurving lateral portions (*pn'*), and between this and the supposed apical point the cartilage is seen to be absent.

The same section illustrates a few other points of interest. The prevomer or dumbbell-shaped bone (*P.vo.*) is seen cut longitudinally. Immediately in front of it Jacobson's cartilage (*J.c.*) may be noticed at the place where towards the anterior part of the organ the cartilages meet in the middle line. Behind the

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* R. Owen. "Monotremata." Todd's Cyclop. Anat. and Phys.

prevomer a small piece of cartilage is seen cut across (*S.c.*). This is Stenson's cartilage at the place where near the posterior part of Jacobson's organ it passes below the organ and meets its fellow of the other side. Behind this are seen the maxillary and the vomer, and between this latter and the prevomer the large internarial opening recently described by Prof. Wilson.*

In the near ally of the Platypus—the Echidna—the condition of the prenasal illustrates the Monotreme type in a much less specialised form. Here we have a closer approach to the condition in the bird. In fig. 2, Pl. XLIV., is represented a median longitudinal section of the anterior part of the snout. The nasal septum (*n.s.*) closely resembles that in *Ornithorhynchus*, and like it divides into a small upper part (*a.n.s.*) and a larger lower—the prenasal (*p.n.*). The upper, as in the Platypus, supports the alinasals, but instead of passing straight forward, at its anterior part it becomes folded back and rests on the symphysis of the premaxillaries. In the very young specimens as figured by Newton Parker† the prenasal is well developed and bears much resemblance to that in *Ornithorhynchus*. As the animal reaches maturity the prenasal, however, becomes reduced by the developing premaxillaries into a thin plate of hyaline cartilage lying between the adjacent parts of the two bones. In old specimens the hyaline cartilage becomes partly ossified and partly converted into fibro-cartilage, only a little of the original tissue remaining. There is no apparent anterior extension of the prenasal comparable to that in *Ornithorhynchus*.

As has been already remarked in the higher forms, the prenasal is usually aborted by the great development of the premaxillaries. In the Australian Bat (*Miniopterus schreibersii*, Natt.), however, as the premaxillaries do not meet in the middle line, we have

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* J. T. Wilson. "Observations upon the anatomy and relations of the Dumbbell-shaped Bone in *Ornithorhynchus*, &c." Proc. Linn. Soc. N.S.W. (2nd Ser.) Vol. ix. 1894.

† W. N. Parker. "On some points in the Structure of the Young of *Echidna aculeata*." Proc. Zool. Soc. 1894.

here an opportunity of seeing the uncomplicated higher mammalian condition, and though the bat is high in the scale of organisation it will thus be well to consider it first. If a transverse vertical section be made in the plane which passes through the opening of Jacobson's organ into Stenson's duct there is seen (fig. 4) a delicate nasal septum (*n.s.*) which does not reach the level of the nasal floor, with on either side of its base the usual cartilages of the nasal floor (*n.f.c.*), here distinct from the alinasals. Inferiorly Stenson's ducts (*n.p.c.*) are seen passing up from the palate with between them the papilla. Round the upper part of the duct is a sickle-shaped piece of cartilage whose inner part, surrounding what is practically the anterior part of Jacobson's organ, is the anterior continuation of Jacobson's cartilage, and the outer part of which is the similar continuation of Stenson's cartilage. Between the portions representing Jacobson's cartilage is found a small median mass (*p.n.*) which from its relations may almost certainly be regarded as the prenasal. Posteriorly this cartilage has no connection with the nasal septum, but it occupies a position somewhat similar to that of the prenasal in the fœtal calf (fig. 7). A very little in front of this plane the small prenasal is seen sending downwards two lateral plates which pass one to each side of the papilla and thus forming its framework (*p.n.* fig. 5). There is no further anterior extension. Though the downward lateral processes can hardly be homologous with the lateral extensions of the prenasal in *Ornithorhynchus*, they illustrate potentialities of the structure usually latent. The condition is, however, specially interesting as throwing light on the peculiar structures found in the Marsupials.

In both Diprotodont and Polyprotodont Marsupials there is in the anterior part of the palate an unusually well marked papilla which generally separates the naso-palatine ducts considerably. It is remarkably developed in the Wombat and very well in the Phalangers. In all the forms I have examined (*Macropus*, *Trichosurus*, *Dasyurus* and *Perameles*) this papilla is supported by a cartilaginous plate. In the adult *Trichosurus* there is a median ridge from which lateral plates pass off. Here and there the

lateral portions are detached or perforated, as if the whole plate were fundamentally a median structure with lateral expansions. In fig. 6 is represented a transverse vertical section of the snout of the Bandicoot *(Perameles nasuta)* in the plane of the anterior part of Jacobson's Organ. Here there is no distinct ridge in the middle line, and the plate is moderately uniform in thickness. This papillary cartilage has no direct connection with any other cartilage. In fig. 3 is shown a median longitudinal section of the nasal region of a pouch specimen of the common Phalanger *(Trichosurus vulpecula*, Kerr), illustrating the relations of the small papillary cartilage (*p.c.*). The premaxillary (*Pmx*) is seen united with the prevomer which forms its palatine process (*p.Pmx*): a dotted line indicates the limits of the different elements as observed in sections slightly out of the mesial plane. The posterior end is found situated near the posterior border of the symphysis of the premaxillary proper, as if it were shut off from its proper relations by the union of the premaxillary with the prevomer. When fig. 6 is compared with fig. 5 representing the condition in the Bat the resemblance between the cartilages of the papillæ is most striking; the only important difference is that in the Marsupial the upper portion representing the prenasal proper is lost. While thus we have in the Bat a prenasal cartilage which gives rise to a support for the papilla, in the Marsupial we have the remains of a similar development, only the papillary portion being left.

In Klein's* paper on the Organ of Jacobson in the Guinea Pig in referring to the relations of Stenson's ducts near their palatal opening he calls attention to "a smaller or larger apparently isolated nodule of cartilage found between the two ducts." This he regards as a detached portion of Stenson's cartilage, but in view of this condition in Marsupials and the Bat I think not improbable that it may be the rudiment of a prenasal development.

Fig. 7 represents a section of the nose of a 6-inch fœtal calf. Here the prenasal is well developed and passes between the premaxillaries. This condition shows the connection between the

* Q.J.M.S. Vol. xxi. (1881), p. 229.

Monotreme type on the one hand and that of the Bat on the other, while by contrasting figures 7, 4, 5 and 6 the nature of the Bat and Marsupial developments becomes manifest.

My best thanks are due to Mr. A. G. Hamilton for the specimen of bandicoot examined, and to Prof. Wilson and Mr. J. J. Fletcher for other kind assistance.

EXPLANATION OF FIGURES.

Plate XLIV.

Reference Letters.

a.n., anterior nares—relative position indicated by dotted lines; *a.n.s.*, anterior portion of nasal septum; *c.*, supposed remnant of caruncle; *Fr.*, frontal; *i.n.p.*, internasal passage; *J.c.*, Jacobson's cartilage; *J.o.*, Jacobson's organ; *Mx.*, maxillary; *Na.*, nasal; *n.f.c.*, nasal-floor cartilage; *n.p.c.*, naso-palatine canal; *n.s.*, nasal septum; *p.c.*, papillary cartilage; *Pmx.*, premaxillary; *p.n.*, prenasal cartilage; *p.n'.*, prenasal at its anterior part; *p.Pmx.*, palatine process of the premaxillary; *P.Vo.*, prevomer; *S.c.*, Stenson's cartilage; *Vo.*, vomer; *v.s.*, vascular spaces; *, supposed apical point of primitive beak in Platypus; †, a small detached piece of cartilage of doubtful signification.

Fig. 1.—Longitudinal median section of the snout of *Ornithorhynchus* (× 5).

Fig. 2.—Longitudinal median section of the snout of *Echidna* (× 5).

Fig. 3.—Longitudinal median section of head of 4-in. mammary fœtus of common Phalanger *(Trichosurus vulpecula)* (× 4).

Fig. 4.—Transverse vertical section of portion of nose of Australian Bat *(Miniopterus schreibersii*, Natt.) in the region of the outlet of Jacobson's organ (× 45).

Fig. 5.—Transverse vertical section of portion of nose of Australian Bat *(Miniopterus schreibersii*, Natt.) near the front of Stenson's duct (× 45).

Fig. 6.—Transverse vertical section of portion of nose of the Bandicoot *(Perameles nasuta)* in region of the anterior part of Jacobson's organ (× 12).

Fig. 7.—Transverse vertical section of portion of nose of 6-in. fœtal calf (× 6).

ON A SMALL FOSSIL MARSUPIAL WITH LARGE GROOVED PREMOLARS.

By R. Broom, M.D., C.M., B.Sc.

(Plates xxv. and xlv.)

At the Meeting of the Linnean Society on 26th June I communicated a paper "On a new fossil Marsupial allied to *Hypsiprymnus*, but resembling in some points the *Plagiaulacidæ*," in which I described two fragments of the upper and a portion of the lower jaw of a small Marsupial, under the name *Burramys parvus*, and regarded the form as being related to the Rat Kangaroo, but exhibiting apparently by a parallel development some characters of the *Plagiaulacidæ*. Of this paper an abstract was published at the time. Since then I have been fortunate in discovering some more perfect specimens which throw much additional light on the structure of the form. I have therefore thought it advisable, with the permission of the Council, to withdraw the previous paper and give a more complete description in the light of the more recent finds.

The specimens I have obtained are all from a small calcareous deposit in the neighbourhood of Taralga, N.S.W. This deposit is situated on the very top of a limestone hill, and is evidently the remains of the floor of a cave, whose roof and sides have long since been weathered away. The stone is very hard and consists of a brownish lime deposit in which are imbedded innumerable small bones, with the remains of a few stalactites and an occasional calcite rhomb. The bones are mostly those of small marsupials, though I have also found the remains of at least one species of rodent and the very perfect cranium of a small bird.

Most of the marsupials belong either to extinct species or to species not now living in the district.

The subject of the present paper is one of the most interesting forms found, and as I am not aware of its having been previously observed, and as its dentition is unlike that of any known marsupial, I have formed a new genus for it, called after the aboriginal name of the district.

BURRAMYS PARVUS, gen. et sp. nov.

The form is characterised by having above and below a large grooved premolar followed by three well developed molars. In the lower jaw the large premolar has six well marked grooves on each side passing upwards and slightly backward and giving the tooth a serrated edge. As the grooves run approximately parallel to the anterior border of the tooth and to each other, and as the anterior and posterior borders converge considerably above, there is left a considerable portion of the posterior part of the tooth ungrooved. This premolar is placed obliquely in the jaw, the line of its edge passing considerably outwards from the line of the molars. The first molar bears some resemblance to the corresponding tooth in *Petaurus*, having two posterior and a large anterior cusp: it differs, however, in the anterior cusp pointing more outwards. The second molar is slightly oblong and has four well developed cusps; of these the anterior outer cusp has a small secondary one springing from it, while the posterior inner one is partly divided by a well marked furrow. The third molar is less developed and apparently quadritubercular. Behind this there appears to be a rudimentary single rooted and apparently functionless fourth molar, which is generally lost in the specimens found. In front there is a long straight flattened and pointed incisor directed considerably upwards from the axis of the jaw. Between the base of this incisor and the anterior part of the large premolar are five minute tooth sockets which have apparently been occupied by two double-rooted premolars and a single-rooted anterior tooth—possibly a minute second incisor. Behind, the jaw has a very marked inflected angle

which passes somewhat downwards. The large depression on the outer side is bounded in front by a well marked ridge, but does not communicate with the dental canal. The main portion of the jaw supporting the molars and the large premolar is very stout proportionately. In the upper jaw only the cheek teeth are at present known. There is a large premolar grooved and serrated as in the lower jaw, having six well marked grooves which run downwards and backwards. The grooves run parallel to the anterior border and leave the posterior and upper third of the tooth ungrooved. Behind the large premolar are three true molars: whether there may be a rudimentary fourth as in the lower jaw is at present unknown. The first is the largest. It has two moderately large blunt tubercles on the outer side, and two smaller ones on the inner, while a small fifth is situated at the anterior and inner corner. The upper third molar is small.

The following are some of the principal measurements :—

From 1st to 3rd upper molars	3·2 mm.
Length of 1st upper molar.....	1·3 mm.
Height of upper premolar	1·7 mm.
Length (antero-posterior) of upper premolar ...	2·0 mm.
From 1st to 3rd lower molars	3·5 mm.
Length of lower incisor	6·3 mm.
From point of lower incisor to front of premolar	8·2 mm.
Depth of lower jaw at 1st molar	3·5 mm.

Locality.—Near Taralga, N.S.W.

Geological Formation.—Pleistocene (?).

Of this form I have discovered five or six moderately good lower jaws, the anterior portion of another, and three fragments of the upper. The hard matrix and the friable nature of the bones render it very difficult to develop the more delicate specimens, and in the case of *Burramys* the difficulty is enhanced by the obliquity of the large premolar, so that it becomes almost

impossible to split the stone without breaking either the bone or the teeth.

Taking into consideration the various points of structure so far as known, it will be noticed that not only does the form present features which distinguish it from any known genus, but that in it we have a combination of characters which render it difficult to be certain whether it belongs to the *Macropodidæ* or to the *Phalangeridæ*. As regards the structure of the jaw, the affinities on the whole are with the latter, and as regards the teeth apparently with the former. The absence of any opening between the dental canal and the hollow on the outer side of the hinder part of the jaw would seem to remove the form from the *Macropodidæ* and point to its connection with the Phalangers. But this point cannot be of any great value, as though the opening is generally absent in the *Phalangeridæ* it is present in the genus *Petaurus*. The large grooved premolars, though much better developed proportionally, appear to be constructed on the same type as those of *Epyprymnus* (*Hypsiprymnus*) and a type quite distinct from that of the Phalangers. In *Trichosurus* where there are rudimentary indications of grooves it is on the hinder part of the tooth, the anterior part being developed into a powerful smooth cusp. The molars present a somewhat archaic type. There is no indication of ridging as in most of the existing types, nor is there the simple regularity of cusps found in *Petaurus*. In the little accessory tubercles we seem to have a feature suggestive of the multi-tubercular molars of the Secondary Marsupials. The minute premolars certainly recall the similar rudimentary teeth in *Pseudochirus*, *Petaurus*, &c., but similar rudimentary teeth must also have been present in the primitive *Macropodidæ*.

On the whole it would seem that we have in *Burramys* one more link in the chain binding the Kangaroos and the Phalangers. The main links would thus be—*Macropus*, *Epyprymnus*, *Hypsiprymnodon*, *Burramys*.

The types have been placed in the Australian Museum, Sydney.

REFERENCES TO FIGURES.

Plate XLV.

Burramys parvus.

Fig. 1.—Outer view of lower jaw (× 10)

Fig. 2.—Upper view of anterior part of right lower jaw (× 10).

Fig. 3.—Upper view of lower right cheek teeth (× 13).

Plate XXV.

Fig. 1.—Inner view of left mandible (× 5).
Outline of jaw from another specimen.

Fig. 2.—Portion of left upper jaw showing the large premolar and the origin of the zygomatic arch (× 13). (The front part of the maxillary and the zygomatic arch are considerably foreshortened.)

Fig. 3.—Right upper cheek teeth (× 13). (The premolar is broken off near the base, and only the roots of the third molar are shown; judging from the lower teeth the roots of m^3 have evidently been slightly displaced outwards.)

ON A SMALL FOSSIL MARSUPIAL ALLIED TO *PETAURUS*.

By R. Broom, M.D., B.Sc.

(Plate xlvi.)

In the bone breccia deposit in the neighbourhood of the Wombeyan Caves in which I discovered *Burramys*, I have been fortunate in finding the remains of another small marsupial, also new to science. Of this form I have obtained the greater part of an upper jaw, and an almost complete and two imperfect lower jaws, and also a most important portion of the cranium.

From the structure of the teeth the form is closely allied to *Petaurus* and to *Gymnobelideus*, and though further details may lead to its being included in one or other of these genera, as it presents features distinct from both and also affinities with each I have provisionally placed it in a new genus.

Palæopetaurus elegans, g. et sp.nov.

Dental Formula :—As in *Petaurus* and *Gymnobelideus* so far as known.

Upper Jaw :—Incisors unknown; canine somewhat conical, less flattened than in *Petaurus* and somewhat shorter proportionately; first premolar smaller than the canine, conical and rather blunt at the apex, single-rooted, antero-posterior length of base very slightly greater than the height, in the unworn tooth possibly less; second premolar (pm.^{3}) with very low crown as in *Petaurus* and considerably developed antero-posteriorly, with the main cusp a little in front of the centre of the tooth instead of behind it as in *Petaurus*, and with two well developed diverging roots; third premolar (pm.^{4}) large and triangular, proportionately larger than in *Petaurus* and *Gymnobelideus*,* and appreciably higher than the canine; first molar differing from *Petaurus* in having the two

* McCoy. Prodr. Zool. Vict. Decade x. Pl. xci. (1883).

inner cusps very small and brought close together, giving the tooth more of a rounded triangular shape than the rough quadrangular in *Petaurus*—judging from the figure a similar condition would seem to be present in *Gymnobelideus*; second molar apparently similar to the first and thus differing from *Gymnobelideus*, where it appears to be oblong and quadrangular; the fourth molar appears to resemble that of the two allied genera.

Lower Jaw :—Incisor well developed, almost horizontal, sharp pointed and curving slightly upwards; minute premolars unknown, but judging from the sockets probably as in *Petaurus;* fourth premolar about half the size of the first molar with a blunt pointed cusp on the middle of the anterior half, and a rounded cusp on the posterior end; the first molar similar in structure to that in *Petaurus*, but with a less development of the anterior cusp; the second molar differs from that in *Petaurus* in having a greater development of the anterior and inner cusp, which from the inner side gives it much the appearance of the first molar; third and fourth molars unknown.

The lower jaw is much slenderer than in *Petaurus*, and bears a considerable resemblance to that in *Gymnobelideus*. The external muscular depression is even shallower than in *Petaurus breviceps*. In *Gymnobelideus* according to the figure the depression ends in front rather sharply towards the lower part of the jaw, as in *Petaurus*. In *Palæopetaurus* the depression ends, but not abruptly, somewhat above the line of the axis of the jaw, and thus differs from both the allied genera. The angle of the jaw appears to be slender, and more like that of *Gymnobelideus* than of *Petaurus*.

Of the upper jaw little is known beyond the teeth, but sufficient of the palate is preserved to show that though there may have been a palatal vacuity, it must have been much smaller than in *Gymnobelideus*.

I have discovered two perfect frontal bones, which, with little doubt, are to be referred to this form. These present a remarkable resemblance to those of *Gymnobelideus*, and differ from those of *Petaurus* in the absence of the post-orbital ridges.

The following are some of the principal measurements :—

Upper jaw.		Lower jaw.	
Canine, height about	1·1 mm.	Length of lower jaw from front of incisor to condyle.....	23·2 mm.
ant. post. length about...	1·1 ,,	Depth behind m^3	3·3 ,,
1st premolar, height..	·8 ,,	Depth behind m^1	3·8 ,,
ant. post. length	·9 ,,	Lower molars.....	6·3 ,,
3rd premolar, height	·4 ,,	Incisor.....	5· ,,
ant. post. length	1· ,,	Incisor to m^4	13· ,,
4th premolar, height	1·2 ,,		
ant. post. length	1·6 ,,		
1st molar, ant. post. length	1·8 ,,		
2nd molar, ditto.....	1·7 ,,		

Locality.—Near Taralga, N.S.W.

Formation.—Pleistocene (?).

In taking into consideration the various points considered above, it will be observed that the remains are those of a small animal in many respects resembling *Gymnobelideus*, but with a number of the characters of *Petaurus*. In many respects it stands intermediate between the two genera, and not improbably may be the common ancestor of both. In *Gymnobelideus* upper pm^1 and pm^3 are described as "both triangular and single rooted." In *Petaurus* all the upper premolars are "two-rooted." In *Palæopetaurus* we have the intermediate condition in pm^1 single-rooted, and pm^3 double-rooted. Then, again, as to the relative sizes of these teeth, in *Petaurus* we have "p^1 nearly as large as p^4, p^3 much smaller, but not minute." In *Palæopetaurus* pm^4 is at least a half larger than pm^1, while pm^3 is but half the height of pm^1. In *Gymnobelideus* the two front premolars are much more equal.

In conclusion I must express my gratitude to Mr. J. J. Fletcher for his kindness in furnishing me with references, &c.

EXPLANATION OF PLATE.

Palæopetaurus elegans.

Fig. 1.—The right maxillary teeth with palate—viewed slightly obliquely from below (× 8·3).

Fig. 2.—Outer view of right lower jaw (× 4).

Fig. 3.—First and second lower molars—viewed from within (× 16).

ON THE ORGAN OF JACOBSON IN AN AUSTRALIAN BAT *(MINIOPTERUS)*.

By R. Broom, M.D., B.Sc.

(Plate xlvii.)

In the course of a recent investigation of certain details in the comparative anatomy of Jacobson's Organ, the results of which I have embodied in a thesis recently presented to Glasgow University, I discovered in the common little Australian bat, besides a number of other interesting points, a well-developed organ of Jacobson.

Jacobson's Organ, as is well known, is found in the large majority of Mammals—from the Monotremata, where it is greatly developed, to man, where it is rudimentary. In the majority of orders it is typically present, but in the higher forms it is frequently absent. Herzfeld,* who has examined a very considerable variety of animals, found it quite absent in two Old World Monkeys, *Cercopithecus* and *Innus*, though present in the New World genus, *Hapale*, and also in the Lemur. Among the *Chiroptera* he found the organ to be absent in the flying-fox *(Pteropus edwardsi)*, and also absent in a native (German) bat, of which unfortunately the species was not determined. From these observations it has naturally been concluded that the organ is absent in the order *Chiroptera*.

Since giving notice of the present communication, and on the eve of sending it off, Dr. Elliott Smith, has kindly called my attention to a paper just recently published on the Organ of Jacobson in the *Chiroptera* by Mm. Duval and Garnault†. In

* P. Herzfeld, "Ueber das Jacobson'sche Organ des Menschen and der Saügethiere." Zool. Jahrb. 1889.

† M. Duval and P. Garnault, "L'organe de Jacobson des Chiroptères"; Compt. Rend. Hebd. des Séances de la Société de Biologie, x. Ser. 28 June, 1895.

this paper the authors call attention to the fact that the organ is not invariably absent in the order, and comment on the curious fact that though the organ is quite absent in *Vespertilio murinus* and *Rhinolophus ferrum-equinum*, in another insectivorous bat, *Vesperugo pipistrellus* there is a moderately developed organ. They do not, however, appear to have made any study of the peculiarities of the organ.

In the common Australian bat which I have studied (*Miniopterus schreibersii*, Natt.) the organ is not only present, but is unusually well-developed; and furthermore it presents certain features which distinguish it from the ordinary mammalian type.

In my recent thesis have been recognised in the Placental Mammals and Marsupials at least three types of Jacobson's Organ, and of the third type two well marked varieties. In the Marsupialia we have a simple generalised type which is moderately closely related to Monotreme type as found in *Echidna*. The organ in Rodents, on the other hand, is peculiarly specialised in opening into the nasal cavity and not into Stenson's duct, though in other respects it comes near to the Marsupial type. In all the other orders of Mammals in which the organ has been examined, so far as I am aware, a third type is followed. Here the organ opens into Stenson's canal as in Marsupials, but the canal is greatly developed in length and passes forwards, becoming merged with Jacobson's duct. There is further a precurrent process of Jacobson's cartilage on the inside of Jacobson's duct, and a similar process on the outer side of Stenson's duct. These, on passing forward, unite above and form a common cartilage for the common duct. This is the type of the Dog, Cat, Sheep, &c. In the bat we have a variety of this type. The cartilages and ducts are arranged in a somewhat similar way, but there is an absence of the great elongation of the ducts, which in their mode of connection with the nasal cavity, and with Jacobson's Organ, present a much nearer approach to the simple Marsupial type.

In *Miniopterus*, though the premaxillaries are fairly well developed, they do not meet in the middle line, a condition

differing considerably from the normal mammalian type. In the middle line is a well developed papilla, supported as I have elsewhere* shown by a development of the prenasal cartilage. A section through the middle of the papilla shows on either side a wide Stenson's duct, which at its upper part is roofed over and protected at the sides by the anterior developments of Stenson's and Jacobson's cartilages. Above this is found the curved cartilage of the nasal floor.

A short distance behind this plane, in a manner similar to that figured by Herzfeld† in the Lemur, the cartilage of the nasal floor becomes divided into an inner and an outer part, as does also the arched cartilaginous roof of Stenson's duct. The two inner parts unite to form Jacobson's cartilage proper; and the outer to form the hinder part of Stenson's cartilage. This is the condition shown in fig. 1. At the inner side of the upper part of Stenson's duct it is found receiving the duct of Jacobson.

Almost immediately behind this Stenson's duct is found opening into the nasal cavity (fig. 2). Here Jacobson's duct is small, and lined with squamous epithelium. On this plane there is no ossification in the neighbourhood of the septum, but a very short distance beyond brings us to a plane cutting the anterior part of the prevomer (fig. 3, *P.vo.*). In a recent paper read before this Society‡ I called attention to this remarkable bone in discussing the homologies of the palatine process of the premaxillary. It is well illustrated in figs. 4 and 5—the former representing an anterior section; the latter a section near its posterior part.

On approaching the region of the prevomer, Jacobson's Organ gradually becomes greatly developed, attaining its maximum near the posterior part of the prevomer. In this region the cartilage of Jacobson forms an almost complete tube, only open slightly on

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* Proc. Linn. Soc. N.S.W. 2nd Ser. Vol. x. pt. 4, 1895.

† *L.c.*

‡ Proc. Linn. Soc. N.S.W. 2nd Ser. Vol. x. pt. 3, 1895.

the outer side. Both the upper and lower ends curve inwards slightly and suggesting the formation of a rudimentary turbinal. The organ itself on section is found to have the usual mammalian shape, though here the regular kidney-shape is slightly distorted, assuming more the Marsupial pattern. The inner wall is composed of the usual neurepithelium, the epithelial cells apparently having short cilia. The outer wall has epithelium with long cilia. A single small blood vessel runs parallel to the organ along the hollow of the outer wall—a feeble representative of the large vascular plexuses of *Echidna* and *Ornithorhynchus*, or even of the rabbit. Of mucous glands there are apparently none within the cartilaginous capsule, and no very abundant supply outside. A number of the septal glands towards the posterior part of the organ appear to supply it with fluid. The organ ends very abruptly.

Stenson's cartilage is well developed, and passes inwards beneath the capsule of Jacobson, somewhat resembling the condition in *Echidna*.

In conclusion the type of organ appears to be intermediate between that of the Marsupial and that of the Carnivore, though more nearly allied to the latter. As regards the relative size of the capsule of Jacobson, it is larger than in any other mammal I know of, even larger than in *Ornithorhynchus* proportionally; in the larger animal, however, owing to the relatively smaller size of the cells, there must be a very much larger number of nerve elements.

I must acknowledge my indebtedness to Messrs. Etheridge and Waite, of the Australian Museum, for identifying for me the bat; and also to Dr. Elliott Smith who not only called my attention to the paper by Duval and Garnault, but most kindly made for me a manuscript copy of the paper, which I could not otherwise have had an opportunity of seeing.

EXPLANATION OF PLATE.

Reference Letters:—*J.C.*, Jacobson's cartilage; *J.D.*, Jacobson's duct; *J.O.*, Jacobson's organ; *n.s.*, nasal septum; *p.n.*, prenasal; *P.vo.*, prevomer; *S.D.*, Stenson's duct; *S.C.*, Stenson's cartilage; *vv.*, veins.

Figs. 1-3.—Transverse vertical sections through anterior part of Jacobson's organ (× 25).

Figs. 4-5.—Transverse vertical sections through anterior and posterior parts of Jacobson's organ (× 60).

Fig. 6.—Section across posterior part of Jacobson's organ, showing its relations and relative development (× 12).

NOTE ON THE PERIOD OF GESTATION IN *ECHIDNA*.

By R. Broom, M.D., B.Sc.

On 5th September I had brought me an adult male and female *Echidna*, which had been found together. There was no egg or young one about the female, and little indication of even the pouch. Considering it probable that impregnation had taken place, I resolved to keep the specimens alive and await developments. The two were placed together in a large box that their behaviour might be noted; but they appeared to have no interest in each other. The male was rather inactive, and unless disturbed, for the most part remained quietly in the bottom of the box. The female, on the other hand, was most persistent in its bids for liberty, and twice succeeded in escaping; on one occasion splitting a $\frac{3}{8}$-in board and wrenching out three nails. Fortunately, on both occasions, it was recaptured. The male, which absolutely refused to take either food or drink, died on the 18th of the month. The female continued to be apparently in the best of health. Occasionally it would take a little milk or water, but curiously enough refused ants; and when placed on an ant bed its only desire seemed to be burrow. In fact it was this unusually great desire to burrow that led to its capture on the two occasions it escaped.

On the 2nd October, on taking the *Echidna* out of the box, I found that it had developed a well marked pouch, and that in it had been placed at its most posterior part an egg. Though well protected by the lateral folds of the pouch, the egg seemed chiefly secured by the long hairs plastered across it. Among the straw was found a second egg, apparently discarded. As there was no signs of any egg on 30th September, it is probable that one egg was laid on the 1st October and the other on the 2nd. After protecting the pouch egg safely for three days, the mother seems to have removed it, as the torn egg membrane or "shell" was found on the bottom of the box, the contents having been presumably sucked.

Though the female thus disappointed me in my hope of finding accurately the period of incubation, it enabled me to arrive at an approximate idea of the period of gestation. The evidence on this point would have been more conclusive had the sexes been kept apart, but as the male died on the 18th, and was in a very low condition for some days previously, impregnation could not well have taken place later than the 12th, and as during the period of captivity neither appeared to have any interest in the other except to use the body of its companion as a stepping stone while endeavouring to climb out of the box, it seems highly probable that impregnation had taken place when the specimens were captured. If this be so, the period of gestation would be about 26 or 27 days, and even if this were not so, as impregnation could not well have taken place later than the 12th, the period of gestation could not be less than 18 or 19 days.

The eggs of my specimen appeared considerably paler than that figured by Semon,* being of a light cream colour. The unbroken egg measured 14 mm. in its long axis, and about 12·5 mm. across.

I must express my thanks to Prof. Wilson for having had an opportunity of seeing Semon's work.

Addendum (7th Feb., 1896).—I have recently had an opportunity of seeing the person who first observed the two Echidnas referred to above—Mr. Angus McInnis. He states that the two were lying together on a slight hollow at the root of a tree, and so far as he could observe front to front, but as on his near approach the two separated and endeavoured to escape, he could not be certain of their exact positions before being disturbed. He, however, assures me that on picking up the male its copulatory organ was protruding about a couple of inches; so that there can be little or no doubt but coitus had just taken place. This, he further states, was on the day previous to my getting them, or 4th September. This additional information removes the previous uncertainty, and enables us to fix the period of gestation at about 28 days.

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* R. Semon. "Zool. Forschungsreisen in Australien u.d. Malay. Archipel. Band ii.; Monotremen und Marsupialier." Jena 1894.

PRELIMINARY NOTE ON THE OCCURRENCE OF A PLACENTAL CONNECTION IN *PERAMELES OBESULA* AND ON THE FŒTAL MEMBRANES OF CERTAIN MACROPODS.

By Jas P. Hill, Demonstrator of Biology, in the University of Sydney.

(Plate xlix.)

Some little time ago there came into my hands, through the kindness of Mr. A. M. Lea, a female short-nosed Bandicoot, *Perameles obesula*, which proved, on examination, to be pregnant. Two embryos were found in the left uterus, and one, the largest of the three, in the right. This latter embryo measured 8·75 mm. from end to end of the curved body.

On opening the uteri it was found to be impossible to remove the embryos without tearing the fœtal membranes, and so two of them were preserved enclosed in their membranes and attached to portions of the uterine walls.

Recently I have had the opportunity of examining these embryos in some detail, both macroscopically and microscopically in serial sections, with the result that a true allantoic placenta was discovered.

The fœtal membranes need not be specially considered in this note, since they have essentially the same general arrangement as those of *Phascolarctus* and *Aepyprymnus*, recently described by Prof. R. Semon.* As in these forms the embryo is sunk into the yolk sac, and is partially surrounded by the invaginated upper portion of the yolk sac wall consisting of splanchnopleure (splanchnic mesoderm and entoderm), and distinguished by Semon as the "inneres Blatt." This inner leaf does not, however, so completely surround the embryo in *Perameles* as in *Macropus*,

* Zoologische Forschungsreisen in Australien. Zweiter Band, Erste Lieferung. Monotremen und Marsupialier, von R. Semon.

Aepyprymnus or *Phascolarctus*, and thus the portion of the serous membrane consisting of ectoderm and somatic mesoderm and limiting the extra-embryonic cœlom externally forms a discoidal area of considerable size. With this discoidal area of the serous membrane the allantois fuses, and over it the placental connection is established.

The allantois is well developed and large, and provided with an abundant blood supply. It consists of a long and somewhat flattened stalk, and a terminal expanded and much flattened vesicular portion. The allantoic stalk leaves the embryo immediately behind the yolk stalk, bends round the right side of the embryo, and extending through the extra-embryonic cœlom expands at its distal end to form the flattened vesicular portion which spreads over the discoidal area of the serous membrane above mentioned. In the stalk the allantoic cavity is reduced to a narrow compressed canal, appearing in sections as a mere slit, lined by greatly flattened entodermal cells. This narrow canal opens distally into the cavity of the vesicular portion of the allantois, which is likewise lined by a thin layer of flattened entoderm. The cavity of the vesicular portion is greatly compressed by the approximation of the allantoic walls, and in sections appears as a long fissure of somewhat varying breadth. One can thus readily distinguish two surfaces in this portion of the allantois—an inner or cœlomic surface and an outer or placental surface.

The mesoderm of the outer surface of the allantois is fused with the mesoderm of the serous membrane so that one can no longer distinguish between the mesenchyme of the allantois and that of the serous membrane, and not only so, one can no longer make out the ectoderm of the serous membrane as a distinct and independent layer, the mesenchyme on the outer aspect of the allantoic cavity apparently standing in direct connection with the uterine mucosa. It seems more probable from my preparations that the ectoderm of the serous membrane has fused with the uterine mucosa than that it has disappeared in its entirety. However, my observations on this point are by no means complete, and the

question as to the fate of the ectoderm may be left undecided for the present, especially since I have within the last few days received from Mr. A. G. Hamilton a pregnant uterus of *P. obesula* containing an unattached blastodermic vesicle. The examination of this material will, I trust, throw light on the point in question, and also on certain other points in connection with the structure of the wall of the pregnant uterus.

As a consequence of this union of fœtal and maternal tissues the uterine wall exhibits certain structural modifications. The layer of columnar epithelium which forms the inner lining of the non-pregnant uterus can no longer be distinguished. It has degenerated apparently over the whole extent of the inner surface of the uterus. Also there are present a short distance below the surface of the mucosa, groups of large oval or rounded nuclei, which, in the region of the placental connection are larger and stain much deeper than in the remaining portions of the uterus. These groups of nuclei are probably derived by proliferation from the lining epithelium of the uterus. The uterine glands are large and well developed, their epithelial lining showing no signs of degeneration.

The placenta is supplied with fœtal blood by the allantoic vessels, which consist of a large vein, on either side of which is a small artery. These three vessels extend unbranched in the allantoic stalk. At its distal end the arteries branch out on the inner or cœlomic surface of the vesicular portion of the allantois, while the allantoic vein is formed by the union of two main factors which accompany the main arterial vessels. The latter branch in a dichotomous manner on the inner surface of the allantois, each arterial branch being accompanied by a venous trunk as is characteristically found in the allantois. These vessels ramifying on the inner surface of the vesicular portion of the allantois can be traced round into the mesenchyme of the outer surface, and there they break up into capillaries. The capillaries become closely applied to the surface of the uterine mucosa and form with it a somewhat irregular interlocking system, since they dip down into the substance of the mucosa to form short villous

processes. The uterine mucosa is very richly supplied with blood, the maternal capillaries forming a network on and near the surface of the mucosa, so that fœtal and maternal blood are thus brought into very close relation, readily allowing of transfusion. The allantois of *Perameles* is thus functional both as a respiratory organ and as an organ of nutrition—a distinct advance upon the (according to Semon) purely respiratory function of the organ in *Phascolarctus*.

In view of this discovery of a true allantoic placenta of the discoidal type in *Perameles*, the Marsupialia as a class can no longer be included among the Aplacentalia and the, up to this, universally recognised character of Marsupials "no allantoic placenta" likewise no longer holds good.

The Macropod embryos available for examination consist of intra-uterine embryos of *Macropus parma*, *M. ruficollis*, *M. robustus*, and *M. major*. In this note it need only be mentioned that I am able to confirm Semon's belief that in the arrangement of their fœtal membranes Macropods would be found to conform to his first type, as exemplified by *Aepyprymnus*, in which the allantois never comes into any connection with the serous membrane.

I desire to tender my sincere thanks to Prof. J. T. Wilson for many valuable suggestions during the course of my work.

EXPLANATION OF PLATE.

Diagram of the fœtal membranes of *Perameles obesula*.

The ectoderm is indicated by a thin line, the mesoderm by a thick line, and the entoderm by a dotted line.

Reference letters.

all.c., allantoic cavity; *all.st.*, allantoic stalk; *amn.*, amnion; *cœ.*, extra-embryonic cœlom; *mes.*, mesenchyme of outer surface of allantois fused with mesenchyme of serous membrane; *pro.*, prokalymma of Semon; *s. t.*, sinus terminalis; *ut.*, uterine wall; *y.s.*, yolk sac; *y.s.w.*, invaginated portion of yolk sac wall.

DESCRIPTIONS OF SOME NEW SPECIES OF PLANTS FROM NEW SOUTH WALES.

By J. H. Maiden, F.L.S., and R. T. Baker, F.L.S.

(Plates L.-LIII.)

Leguminosæ.

Daviesia recurvata, sp.nov.

(Plate L.)

A small shrub with erect branches, hirsute, branchlets terete, *not slender*.

Leaves very rigid, small, appressed, numerous, lanceolate, articulate, thick with recurved margins, the midrib only showing at the base on the underside, acuminate, gradually tapering to a straight rigid pungent point; usually about 2 lines long, rarely 4 lines, mostly under a line in breadth, often glabrous on the underside which has a scurfy appearance; the hairs on the upper surface have a basal gland.

Flowers solitary or clustered on filiform pedicels, either shorter or longer than the leaves. Bracts prominent.

Calyx under 1 line long, the turbinate base short, teeth not long, the two upper ones truncate and rather broader than the others, united at the base. Standard about $1\frac{1}{2}$ times as long as the calyx, dark coloured. Keel short, incurved.

Pod not seen.

Analysis showing its relation to cognate species :—

D. filipes. Branches hirsute. Leaves oblong or oval-oblong, not reticulate, straight-pointed, under $\frac{1}{2}$ in. *Shortly* pungent-pointed. Bracts very small.

D. recurvata, sp.nov. Branches hirsute; leaves lanceolate, much acuminate, recurved margins under 4 lines (mostly 2); bracts prominent.

D. squarrosa. Leaves cordate, ovate, much acuminate, usually under ½ in. long; pedicels filiform.

This species differs from *D. filipes* with which it has greatest affinity, principally in having more acuminate and smaller leaves, with revolute margins; also in its smaller flowers, and in the upper teeth of the calyx being scarcely if at all united, as well as in possessing prominent bracts.

The calyx is similar to that of *D. squarrosa*, but the leaves entirely differ from that species.

Hab.—Taloobie, Bylong Creek, Goulburn River, N.S.W. (R.T.B.)

We have proposed the specific name from the recurved margins of the leaves.

Acacia Baeuerleni, sp.nov.

(Pl. li.—right division.)

A shrubby *pubescent* plant of about 3 to 7 ft. as seen; generally 3 to 5 ft., throwing out numerous "switch-like" branchless stems *from the ground.*

Branchlets few, hoary pubescent, angular, mostly subtended by a phyllode, with very prominent decurrent lines.

Phyllodia rigid, mostly about 6 inches long, narrowed at both ends, terminating in a straight recurved pungent point, broadest in the middle, where they are 4 to 5 lines broad, rarely slightly inclined to falcate, coriaceous; veins parallel, numerous, very prominent on both sides, 3 or 4 more distinct than the others, the finer veins occasionally anastomosing. Gland slightly removed from the base, not prominent. Stipules small, about 1 line long, deciduous.

Peduncles solitary, opposite, about 9 lines long, pubescent, bearing a comparatively large, dense, globular head of from 30 to 40 flowers, closely packed, the calyces almost cohering, mostly 5-merous.

Calyx turbinate, lobes obtuse, ciliate, less than half as long as the corolla, more or less hairy, eventually separating into spathu-

late distinct sepals. Petals glabrous, often with red markings. Stamens long and very numerous, filaments white, anthers green.

Pod straight, $3\frac{1}{2}$ to 4 lines long, 3 to 4 lines broad, pubescent, the margins thickened, white and nerve-like.

Seeds oblong, longitudinal, funicle folded 3 or 5 times on itself, and not thickened under the seed.

Hab.—New Italy, N.S.W. (W. Baeuerlen).

Analysis showing affinities to and differences from cognate species :—

Phyllodia linear-lanceolate, 3- or more nerved. Petals smooth or with prominent midribs.

Sepals united. Seeds longitudinal. Peduncles short. Phyllodia under 3 lines. Pod curved	*A. lanigera.*
Peduncles long. Seed oblique and longitudinal. Phyllodia 5 to 6 ″. Pod straight, funicle 4 fold, not thickened under the seed.....	*A. Baeuerleni.*
Peduncles short. Seed oblong, oblique, transverse. Phyllodia 1-$1\frac{1}{2}$″ long, funicle 4 to 5 folds, not thickened.....	*A. phlebocarpa.*
Peduncles short (3″). Seeds compressed globular, longitudinal, funicle 1 fold, thickened under the seed	*A. Simsii.*

We have placed this *Acacia* in the *Pungentes* series of Bentham, and, if rightly so classified, it stands alone in the length and size of its phyllodes, which far exceed in length and breadth that of any other species of the group.

The pungent point of the phyllodes is not always straight, but generally so, and as the phyllodes are certainly rigid, these two points decided us in preferring to place it in the *Pungentes* to the *Plurinerves*.

It bears a general resemblance to *A. Simsii* (Fig. Muell. Ic. Aust. Acacias) and perhaps also to *A. lanigera*, except for the larger phyllodes.

The venation is certainly more like that of the latter species, as is also the vestiture, but the long peduncles, phyllodes and straight pod remove it far from that species. If there were any varietal forms it might perhaps be made a variety of *A. lanigera*, but as specimens of that species obtained from the interior of the Colony and from many parts of the Dividing Range show no perceptible variation, it is impossible to look upon our plant as a variety. We may also mention that the sucker or switch-like appearance of the stems of *A. Baeuerleni* in no way resembles the close thickset shrub *A. lanigera*. The bracteoles appear also to be wanting or are very deciduous.

The individual flowers and head are also larger than those of *A. lanigera*, while the stamens have white filaments and light yellow anthers.

The pods also show no tendency to curve.

Had it come under the *Plurinerves*, then its affinities would be with *A. elongata* and *A. Simsii*, from which species it differs mostly in the shape of the phyllode, length of peduncle, calyx, and shape of seed and aril.

Dedication.—This species is named after Mr. William Baeuerlen, the painstaking botanical collector of the Technological Museum.

Albizzia (Pithecolobium) Muelleriana, sp.nov.

(Pl. lii.)

A tree glabrous in all its parts, height about 50 to 70 feet, as seen, diameter 2 feet, locally known as "Ash."

Pinnæ one pair, rarely two pairs, the common petiole mostly under one inch, each rhachis often short, rarely exceeding two inches. Gland wanting. Leaflets glabrous, usually one pair subtended by an odd one, exceptionally composed of three or four leaflets irregularly placed along the rhachis, ovate acuminate, obtuse, or oblanceolate, acuminate, the cuneate base narrowing into a distinct hairy or pubescent petiolule, articulate with the rhachis; 1 to 5 inches long, reticulately penniveined on both sides, but much more prominently so on the underside, paler above.

Panicles in the upper axils or loosely racemose, exceeding the leaves; peduncles flat or angular. Flowers up to about 15 in globular umbels, sessile. Calyx glabrous, 2-3 lines long, shortly toothed, ciliate, campanulate or cylindrical. Corolla exceedingly short in the bud, glabrous, 2-3 lines long, equally 5-lobed. Stamens green, united below the lobes, 9 lines long. Pistil glabrous. Style elongated, 1 inch long. Ovary surrounded at the base by a cup-shaped gland.

Pod *thick, fleshy,* terete, 2 to 4 inches long, 3 to 4 lines broad, twisting when perfectly ripe and eventually becoming very hard, valves dark red outside, orange-coloured inside.

Seed black, imbedded in the thick fleshy interior of the pod, about 2 or 3 lines long.

Hab.—Marshall Falls, Alstonville, and also Tintenbar, Richmond River; also Mullumbimby, Brunswick River, N.S.W. (W. Baeuerlen).

This species has closest affinity with *Albizzia (Pithecolobium) Hendersoni* and *A. ramiflora*—a specific name, by the way, which would apply equally well to all our Pithecolobiums and Albizzias.

It is distinguished from the former species by its fewer leaflets, which are not at all oblique and are of a much thinner texture and of a lighter colour; the stamens also are shorter.

From *A. ramiflora*, with which it has closest affinity, it is not so easily distinguished, as the description of that species is from imperfect material. It, however, differs from it principally in the size of leaflets and flowers and the petioles not being decurrent.

It can be recognised from *A. pruinosa* by its sessile flowers and fewer and larger leaflets.

The most remarkable feature about this species is the full development of the calyx before the appearance of the corolla, which at its maturity about equals the calyx in length. This fact does not appear to have been recorded in any of the published descriptions or delineations of Australian species.

The following analysis will show its relative position :—

A. Hendersoni. Leaflets very oblique, flowers on very short stalklets, corolla twice as large as the calyx.

A. Muelleriana, sp.nov. Leaflets distinctly petiolate *articulate*, equal-sided, ovate acuminate, corolla shorter than the calyx. Style under 1 inch.

A. ramiflora. Leaflets large, obovate, *shortly decurrent*, corolla very long. Style 4 inches long.

Dedication.—In honour of Baron Sir Ferdinand von Mueller, K.C.M.G., the distinguished Government Botanist of Victoria.

We have used the generic term *Albizzia* instead of *Pithecolobium* in deference to the advice of Baron von Mueller, who writing us on the subject, says :—

"If you look through the Iconography of Australian Acacias and allied genera, you will find that the characters, on which *Pithecolobium* by my celebrated friend Martius was founded, find their counterpart in *Acacia*, and that accordingly also from *Acacia* a number of species would on the same grounds require to be separated. Indeed *Vachellia* has been distinguished by a pithy pod for *A. Farnesiana*, but by common consent *Vachellia* became discarded. It was not on light considerations that I overthrew in the Journal of Bot. for 1872 *Pithecolobium*, at all events for the *Asiatic* and Australian species, there being absolutely no difference between these genera. Whether *Pithecolobium* can be maintained for any S. American species I cannot positively assert. It was founded on species with somewhat succulent pods, such as the monkeys there feed on. Hence the name. But no difference in other respects seems to occur among the *Albizzias* of the eastern and western world. Furthermore, the well known genus *Gleditschia* in Leguminosæ contains species with dry and succulent legumens. What I said of *Gleditschia* applies similarly to the still closer allied genus *Prosopis*."

Compositæ.

Podolepis rubida, sp.nov.

A slender, glabrous (or slightly woolly at the base) divaricate perennial, from 1 to 3 or more feet in height.

Leaves linear, 2 inches long at the base and decreasing in size on the stems on some specimens, while in others 4 inches long at the base, decreasing to 2 inches long on the stem, the upper ones stem-clasping and decurrent, tapering from the base upwards, margins recurved, glabrous above, woolly underneath, but midrib prominent, basal leaves with a loose cottony down.

Flower heads small, on filiform peduncles. Involucre hemispherical, rarely exceeding 3 lines, the scarious laminæ of the bracts rugose, imbricate, ovate or acuminate, decurrent on the whole length of the claw of the inner row of bracts; the claw of the outer bract very short but gradually lengthening to a long linear one on the penultimate or innermost row but one; the claws glandular. Florets yellow, all exceeding the involucre, the outer ones about 3 lines long, ligulate, *shortly* 3- *or* 4-*lobed.*

Pappus bristles fine, not thickened upwards, shortly barbellate. Achenes glabrous.

Hab.—Bathurst, N.S.W. (W. J. C. Ross).

Analysis showing differences from cognate species:—

Involucre large, laminæ very acute acuminate, not rugose. Stem leaves slightly decurrent, basal leaves oblong lanceolate	*P. acuminata*, R.Br.
Involucre small, about 3 lines, outer laminæ very obtuse, inner ones acuminate, *rugose*, stem leaves decurrent, basal leaves linear ...	*P. rubida.*
Involucre 6-8 lines, laminæ very acute, not rugose; annual.....	*P. canescens*, A. Cunn.

It is not easy to indicate the relative position of this species in Bentham's classification of *Podolepis*. It is placed between the two above mentioned species, but it could with perhaps equal fitness be also placed between *P. Lessoni* and *P. Siemssenia*. The large flowers and large basal leaves of *P. acuminata* at once separate it from that species, as do also the acute laminæ and deep incision of the ray florets.

It is easily recognised from *P. canescens* by its obtuse *laminæ* and smaller involucre as well as by the shape of the leaves, and in being a much slender and taller plant, and almost glabrous.

Of all the species in this genus it has the greatest superficial resemblance to *P. Lessoni*, and could easily be mistaken for that species, its chief characteristic difference being its much longer and decurrent linear-lanceolate leaves, rugose scarious laminæ, and the presence of the basal bracts of the involucre.

P. Siemssenia stands apart from it principally by its decurrent, smooth laminæ; "not perceptibly barbellate pappus-bristles;" smaller non-decurrent stem leaves; absence of scarious scales on the peduncles and its shining bracts.

Its specific name has reference to the colour of its stems.

Helichrysum tesselatum, sp.nov.

(Plate liii.).

An erect shrub of several feet, often with thick stems which always retain the prominent decurrent lines of the leaves, the branches closely woolly tomentose.

Leaves narrow-linear with recurved or revolute margins, about $\frac{3}{4}$ of an inch long including the decurrent part, which equals about half its entire length, woolly tomentose underneath, smooth and shining above, rarely with any asperities, obtuse or with a recurved point.

Flower heads numerous, larger than those of *H. diosmifolium*, in rather loose terminal corymbs, sometimes measuring 4 to 5 inches.

Flower heads straw-coloured on woolly white, stouter pedicels than the allied species, larger and less numerous than those of *H. diosmifolium*. Involucre hemispherical or ovoid-turbinate, 3 lines in diameter, or a shade longer than broad, the bracts obtuse, concave, compact, straw-coloured, with spreading tips, the outer ones slightly woolly below the scarious tips. Florets about 35 to 40, a few of the outer ones females.

Achenes hairy. Pappus-bristles slender, serrulate, not thickened upwards.

Hab.—Bylong, Murrumbo (Goulburn River), N.S.W.

Analysis showing differences from allied species :—

Involucral bracts more or less scarious, obtuse, without any or with scarcely conspicuous white tips.

Involucre ovoid-turbinate. Florets above 15. Achenes glabrous or papillose.

Leaves not decurrent..... ..... *H. cinereum.*
,, shortly decurrent .... *H. bracteolatum.*
,, much decurrent... .... *H. tesselatum.*

(The specific name being given in allusion to the strikingly tesselated appearance of the stem, owing to the scars of the bases of the leaves).

This species when first seen in the field has the general facies of *H. diosmifolium*, but its specific differences are readily apparent.

The long, prominent persistent decurrent lines on the old stems, its scarious yellow bracts and larger flowers at once establish its identity.

It approaches slightly *H. adnatum* in having the raised decurrent lines persistent after the leaves have fallen, but its larger flower heads and the more numerous florets, scarious and spreading tips and also the larger and thicker leaves easily distinguish it from that species.

Its nearest affinity is perhaps with *H. bracteolatum*, but this species has *shortly* decurrent leaves and only 15 to 20 florets.

Helichrysum brevidecurrens, sp.nov.

A tall, heath-like shrub, in general appearance resembling *H. diosmifolium*, the branches and underside of the leaves cottony white.

Leaves narrow linear with a recurved point, revolute margins which are decurrent on the stem but not so much as *H. decurrens*,

shining above, but with less asperity than *H. diosmifolium*, about 6‴ long, cottony white underneath.

Flower heads hemispherical or slightly turbinate, rather larger than those of *H. diosmifolium* but less than those of *H. decurrens*, numerous in a terminal corymb.

Involucre *hemispherical*, under 2 lines in diameter, the bracts obtuse, concave, all the outer ones scarious, straw-coloured, with scarcely spreading tips, the inner circle yellow with paler tips. Florets about 25-30. Achenes hairy. Pappus-bristles serrulate, not thickened upwards.

Hab.—Murrumbo, Goulburn River, N.S.W.

Analysis to show cognate species :—

Involucral bracts with concave, erect or loose but *not spreading* obtuse tips, all or the inner ones white or pink.

Leaves not decurrent Florets 20 ..... *H. diosmifolium.*

Involucral bracts more or less scarious, obtuse, without any or with scarcely conspicuous white tips.

Involucre *ovoid-turbinate*, *narrow*. *Florets about* 15. Leaves shortly decurrent... ..... *H. bracteolatum.*

Involucre hemispherical. Florets 25 to 30. Leaves shortly decurrent .... *H. brevidecurrens.*

Involucre hemispherical. Florets 35 to 40. Leaves very decurrent ..... *H. tesselatum*, sp.nov.

As will be seen in the analysis, it has greatest affinities with *H. bracteolatum*, whilst it also approaches *H. tesselatum* in the general resemblance of the involucre, but differs from it in the shortly decurrent and more numerous leaves and smaller flower heads. From *H. adnatum* it is distinguished by the shape of the involucre and number of florets, and the pappus-bristles being not thickened upwards, and its larger heads.

Bignoniaceæ.

Tecoma Baileyana, sp.nov.

(Pl. li.—left division.)

A tall woody climber, glabrous. Leaves pinnate with 7 to 9 leaflets, sometimes exceeding 2 feet, opposite or in whorls of 3 or 4, petiole 3 inches long.

Leaflets oblique, usually 7 but sometimes 9, large, about 5 inches long and over 2 inches broad, ovate acuminate, rounded at the base or shortly tapering into an exceedingly short petiole, pale coloured underneath, reticulations very prominent below but less marked above, margins slightly recurved, articulate on the rhachis.

Flowers in axillary racemes or interrupted spikes from 3 to 15 inches long of a cream colour, but touched inside on the lobes and throat with a delicate shade of pink. Calyx glabrous, 5-toothed, of a purplish-brown colour. Corolla-tube incurved, 6 lines long, not dilated upwards, but perfectly cylindrical, covered inside and out with minute glandular hairs or processes very numerous on the lobes; the lobes almost equal, acuminate-obtuse. Stamens 4, in pairs included in the tube. Pistil longer than the stamens, style with 2 short ovate stigmatic lobes.

Capsule unknown.

Hab.—Mullumbimby Creek, Tweed River, N.S.W. (W.B.)

Analysis showing the differences of this plant from cognate species:—

Flowers in a long raceme or spike, corolla incurved, not dilated upwards, 1 line in diameter. Leaflets about 5 inches	*Tecoma Baileyana.*
Flowers in a loose panicle, corolla slightly incurved and dilated upwards, 3 lines in diameter, leaflets variable, not exceeding 3 inches	*T. australis.*

Flowers compact, corymbose, corolla about 1 inch in diameter..... *T. jasminoides.*

Corymbs of 6 to 8 flowers, corolla about 2 inches long, purplish ..... *T. Hillii.*

The small tubular cream-coloured flowers of this species give it an appearance quite distinct from the other well-known Australian *Tecomas*, so that it is very easy to recognise in its native habitat.

Our idea to make this a variety of *T. australis* was overcome by the fact that *T. australis* with all its variations of foliage preserves, wherever found, a very constant flower, which is very distinct from this new species.

As *T. australis* is also found at Mullumbimby, it can readily be compared on the spot with the new species.

Besides its distinctive flowers the foliage is also characteristic. The foliage of *T. australis* with all its variations of coast, tableland and far interior specimens in no way resembles the large, coriaceous leaflets of this new species.

The calyx of purplish-brown may also be noticed.

We regret that we have not succeeded in obtaining the fruit, but there appears very little hope of obtaining any from the plants from which this diagnosis is made, as they are so situated on a vertical bank that all the fruit must inevitably fall into Mullumbimby Creek.

Discovered on the banks of Mullumbimby Creek by W. Baeuerlen, and who, although collecting systematically in this district for over four years, has only seen one plant.

Named in honour of Mr. Fred. Manson Bailey, F.L.S., the Government Botanist of Queensland.

EXPLANATION OF PLATES.

Plate L.

Daviesia recurvata.

Fig. 1.—Flowering twig.

Fig. 2.—Individual flower.

Figs. 3 and 4.—Standard.

Fig. 5.—Keel.

Fig. 6.—Wing.

Fig. 7.—Pistil.

Fig. 8.—Leaves.

All enlarged except No. 1.

Plate LI.—right division.

Acacia Baeuerleni.

Fig. 1.—Flowering twig.

Fig. 2.—Bud.

Fig. 3.—Individual flower.

Fig. 4.—Pistil.

Figs. 5, 6, 7.—Bracts.

Fig. 8.—Pod showing seed *in situ*.

Fig. 9.—Portion of phyllode magnified.

All enlarged except Figs. 1 and 8.

Plate LII.

Albizzia (Pithecolobium) *Muelleriana.*

1.—Foliage.

2.—Flowering twig.

3.—Individual flower.

4.—Pistil and gland.

5.—Immature pod with part of valve removed to show seeds *in situ*.

6.—Ripe pod—seeds removed.

Plate LIII.

Helichrysum tesselatum.

Fig. 1.—Flowering specimen.

Fig. 2.—Floret.

Fig. 3.—Section of upper part of floret tube.

Fig. 4.—Pistil.

Fig. 5.—Bracts.

Fig. 6.—Portion of stem showing decurrent margins of the leaves on it.

All enlarged except Figs. 1 and 6.

Plate LI.—left division.

Tecoma Baileyana.

Fig. 1.—Flowering raceme.

Figs. 2, 3, 4, 5.—Individual buds and flowers.

Fig. 6.—Section of corolla, showing disposition of pistil and stamens (enlarged).

Fig. 7.—Part of leaf showing leaflets.

OBSERVATIONS ON THE EUCALYPTS OF NEW SOUTH WALES.

By Henry Deane, M.A., F.L.S., &c., and J. H. Maiden, F.L.S., &c.
(The Illustrations by R. T. Baker, F.L.S.)

Part I.

(Plates liv.-lvii.)

Introductory.

The two great works on the genus *Eucalyptus* are the "Flora Australiensis," (Vol. iii. pp. 185-261); and Baron von Müeller's Monograph "Eucalyptographia," a quarto, with illustrations of one hundred species.

For some years past we have been giving particular attention to those species which occur in New South Wales, and, as the result of our investigations, both in the field and from examination of specimens, dried or otherwise, we are in a position to submit some notes which we believe will usefully supplement the works above referred to. The subject is a vast one, and we hope to add to these notes on particular species from time to time. We hope to do for the Eucalypts of New South Wales what Howitt has done for those of Gippsland in his paper "The Eucalypts of Gippsland," (Trans. Roy. Soc. Vict., Vol. ii., Part 1, pp. 81-120).

We trust our facts and suggestions will be found useful as far as they go; they are obviously incomplete in many directions, but we trust that they will lead to the taking of additional observations, and the collection of additional material by botanists and others in every district of the Colony in which Eucalypts are found.

Eucalyptus stellulata, Sieb.

Introductory.—The name is rather happy, and refers to the disposition of the buds, which remind one of a little star or rosette.

Vernacular names.—"Black Sally," Gippsland and Southern New South Wales at least as far north as Goulburn; also New England Ranges. "Black Gum," Bombala.

The above names have been given on account of the rough, hard black bark on the butt.

"Sally Butt," between Bathurst and Orange. The name "Sally," without a qualifying adjective, is in use at Bombala, Boro, Braidwood and Yass. The name is in allusion to the species being often found on the banks of streams, like a sally (sallow or willow). "Olive-green Gum" (Leichhardt). "Green Gum," County of Argyle and Blue Mountains (Macarthur); New England and high land near Braidwood (Dr. Woolls). "White Gum," County of Argyle and Blue Mountains (A. Cunn.). "Blue Gum" (Forester Mecham, Tumut). "Lead Gum," County of Argyle and Blue Mountains; Berrima (Macarthur); Hartley and Mudgee (Woolls).

All the above names, "Olive-green Gum," &c., are attempts to describe the appearance of the smooth portion of the bark, which varies from white with a bluish or lead-coloured cast to even a dirty olive-green.

The species is a stunted gum growing at high elevations, smooth-barked (except at the butt), and looking as if it were blue or lead-coloured with the cold. There are so many White Gums that we think the name "Lead-coloured Gum" is a useful one, while "Black Sally" is better still, and the most widely spread of existing names.

It is called "Muzzle-wood" in Gippsland, but the meaning of the name is unknown to us.

Seedling or sucker leaves.—Ovate-acuminate, larger in size and thinner in texture than the mature leaves. The average dimensions of some seedling leaves in our possession are $3\frac{1}{2}$ inches long by a width of one half this. (Pl. liv., figs. 7-9.)

Mature leaves.—The tips are often hooked like those of *E. coriacea* and of some forms of other species, *e.g.*, *amygdalina*. The leaves of both species when dry are smooth and usually show

black dots (like *E. punctata*), while the parenchymatous tissue is more or less channelled. These appearances are also seen in some forms of *E. amygdalina* and other species, and we draw attention to them in order that too great importance be not attached to them. In *E. punctata* these black dots were considered to indicate a specific difference.

The shape of the leaves is lanceolate to broadly lanceolate. The leaves are smaller than those of *E. coriacea*. The venation springs from the petiole, and the primary veins are prominent and roughly parallel to the midrib.

Timber.—Pale coloured, rarely free from gum-veins, warps seriously, a sound log of any size very rare; of little value for purposes other than fuel. Timber that shrinks much in drying may do so regularly or irregularly. Those of the first class have, when dry, practically the same shape as the original piece, but those of the second class take on irregular shapes. The timbers of *E. stellulata* and *E. coriacea* belong to the latter class.

Variations from type.—var. ANGUSTIFOLIA, Benth. (Syn. *E. microphylla*, A. Cunn. partly) with small, narrow leaves.

Highest parts of the Blue Mountains, *e.g.*, Blackheath and Mt. Victoria. Occurring with the ordinary form in the Kanimbla Valley. See fig. 8.

Range.—Typical form.—The tops of the ranges on the N.S.W.-Victorian border, thence following the Dividing Range and its spurs at least as far north as the New England Ranges, and as far west as 18 miles west of Bathurst, on the Silurian; also at Rylstone. We have specimens from these localities, but it may be reasonably expected to be found further north and further west, in mountainous districts.

EUCALYPTUS CORIACEA, A. Cunn.

Introductory.—This is the name given in the *Flora Australiensis*. Sieber's name *E. pauciflora* has doubtful priority, but it is so inappropriate (no Eucalypt flowering more freely than this), while Cunningham's name is remarkably appropriate, that we feel it our duty to adopt the name *E. coriacea* for this species.

Vernacular names.—One of the "White or Cabbage Gums," but not to be confused with *E. hæmastoma*, var. *micrantha*, which goes by the same names. Its usual name with us is "White Gum," though it is very frequently called "Cabbage Gum" also. The names "Flooded Gum" and "Peppermint" under which this species is known in Victoria (B. Fl.) would not appear to be in use in this colony. As regards the latter name, we suggest that it has arisen from the fact that a form of *E. amygdalina* growing in the south-eastern part of the colony resembles *E. coriacea* in fruits and perhaps in other respects. We have evidence pointing in this direction.

The species goes under the name of "Weeping Gum" in Tasmania, owing to its scrambling habit; the name is also in use at Uralla, N.S.W. At Glen Innes it is locally known as "Tumble-down Gum," also by reason of its aspect.

"Glassy Gum" is a name in use at Guyra, on account of the vitreous appearance of the bark.

"White Sally" is a name in use at Queanbeyan.

Seedling leaves.—Broader than the mature leaves; more or less ovate.

Mature leaves.—Coriaceous, yet often succulent, and hence eaten by stock. They are comparatively large, six inches being a common length, while five inches is perhaps under the average. The width is usually about $1\frac{1}{2}$ inch. They are usually shiny, but in the coldest districts often glaucous. The venation is as stated under *stellulata*, and in this respect not only shows affinity with that species but also with *amygdalina*, particularly through the variety *latifolia* of that species.

Timber.—Pale coloured, full of gum veins; warps a good deal.

Variations from type.—Following are notes on Eucalypts which more or less depart from the typical form of *E. coriacea*:—

(*a*) *E. coriacea* becomes less glaucous in the Delegate district; bark scribbled like *E. hæmastoma*. The young leaves are larger and thinner than those of the type.

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(*b*) Leaf about 4½ inches long, straight or nearly so, *i.e.*, seldom falcate, fruit more nearly sessile. Unripe fruits nearly hemispherical; ripe fruits contracted at the orifice and ovoid. Sometimes glaucous, and apparently connecting with variety *alpina*. The bark is smooth, grey and striped, and is marked by scribbles similar to those of *E. hæmastoma*. The tree is in fact a good deal like that of a large-fruited variety of *E. hæmastoma*, to which we shall subsequently allude, but the venation and consistence of the leaves (not to mention other points) are those of *E. coriacea*.

Cooma District. Cooma and Braidwood Road.

(*c*) Var. *alpina*, F.v.M. (B. Fl. iii. 201). Leaves short and nearly straight. Flowers rather smaller and peduncles shorter.

Mountains on Macalister River, Vic. (B. Fl.).

Specimens of this variety from Mt. Kosciusko, in our own Colony, are very glaucous. Leaves 2 inches long, or a little more. (Pl. liv., figs. 2-3.)

Range.—Usually at fairly high elevations, preferring undulating, grassy country in the ranges and high table-lands. Found practically in the same districts as the preceding species.

E. AMYGDALINA, Labill.

The various forms have leaves which have a strong (sometimes very strong) odour of peppermint, to which circumstance they owe their commonest vernacular name. *E. piperita*, *E. sieberiana* and *E. stuartiana* possess an odour of a somewhat similar character. *E. piperita* and *E. stuartiana*, especially in certain districts, are known by the name of "peppermint," but *E. amygdalina* is the tree which is most usually understood by that name.

We propose to classify the various New South Wales forms we deal with on the present occasion as follows:—

Sucker or seedling leaves narrow.

1. The typical species, comprising a number of forms which do not, at first sight, appear to be connected with each other.

2. Var. *radiata*, containing the tree usually known as "River White Gum."

Sucker or seedling leaves broadish.

3. Variety *latifolia (nobis)*, comprising some of the broad-leaved forms.

There are other forms, at present placed under *amygdalina*, but as our specimens or observations in regard to them are incomplete, we prefer to postpone consideration of them.

1. Typical *E. amygdalina*.

Introductory.—In the case of such a protean species as *E. amygdalina*, it may be useful, and it is certainly interesting, to note what the definition of the species really was, as by different authors the description has been modified very considerably.

The original specimen described by Labillardière came from Tasmania. The following is Don's translation of the species description given in DC. Prod. iii. 219 :—

"Lid hemispherical, nearly mutic, shorter than the cup; peduncles axillary and lateral, nearly terete, length of the petioles; umbels 6-8 flowered, nearly capitate; leaves linear-lanceolate, attenuated at the base, and acuminately mucronate at the apex. Leaves 3 inches long, and 3 lines broad, some unequal at the base, and some equal. Petioles and peduncles 3 lines long. Fruit globose, size of a grain of pepper."

Vernacular names.—Peppermint or Messmate are the most widely used names, and they are perhaps indiscriminately employed. Perhaps the former name is more prevalent as far north as Mittagong and the Blue Mountains, and the latter in New England, but the two names are often employed in the same district for the same tree. Some other local names will be found under *Range*.

Bark.—This is the least variable characteristic; it is sub-fibrous, although on the one hand it sometimes approaches the character of a Stringybark, on the other hand it is often of a

shorter character, resembling the more friable varieties (of barks) of *E. hemiphloia*. It is almost undistinguishable from the bark of *E. piperita*. It is usually of a dark, dirty grey colour. Occurs only on the trunk, or at most on the largest branches; the branches usually quite smooth.

Seedling or sucker leaves.—Opposite, narrow-lanceolate. Probably all the forms have the twigs more or less rusty glandular.

Mature leaves.—This species varies in the size, shape and texture of its leaves. The usual shape is lanceolate, or even broadly-lanceolate, but some forms are linear-lanceolate or even nearly linear, comparatively thick, and the veins very oblique at the base, not prominent, *e.g.*, specimens from Mittagong, and also a tree known as "Silver-top" at Nimitybelle in the extreme south of the Colony. Sometimes the foliage is quite dense; in other cases it is sparse.

This would appear to be the form most generally employed in the manufacture of Eucalyptus oil in this Colony. It is so chosen because its leaves contain an unusually large percentage of oil, which is, however, not at present a favourite in European markets owing to the almost entire absence of cineol (eucalyptol) and the very large percentage of phellandrene. The above remarks are more or less applicable to all forms of *amygdalina*.

Buds.—The shape of the operculum of the western and northern forms (Mt. Victoria and New England) is blunt, being nearly hemispherical; those of the southern forms in our collection are more pointed.

The variability in the shapes of the operculum in *E. amygdalina* is brought out in the plate (comprising two forms) in the "Eucalyptographia."

Fruits.—Although in the original description of the species the flowers are in heads of 6-8, those of some of our N.S.W. forms have at least twice as many, and some perhaps nearly as many as those of the variety *radiata*. None of our specimens have the fruits as pear-shaped as depicted in the drawing of the left-hand

specimen of *E. amygdalina* in the "Eucalyptographia." (See var *latifolia*). Following is a general description of them :—

The fruits are of a pilular shape, though with some slight tendency to pear-shape. They are wide at the mouth and almost hemispherical, somewhat in the manner of *E. acmenoides*. Bentham's "sub-globose truncate" applies to many of the forms.

The tips of the valves are sometimes slightly exserted.

Timber.—Pale-coloured (nearly white) when newly cut, but drying to a pale brown. Often liable to gum veins, which tend to form thin concentric rings. Of inferior durability and strength as a very general rule, but we have some apparently well authenticated instances of the durability of this timber for posts and shingles in the New England District.

Range.—Extending from Victoria along the various coast mountain ranges and their spurs at least as far north as New England, and westerly as far as the western slopes of the Blue Mountains.

Some specific localities in this Colony may be stated as follows: —Mountain Top, near Nimitybelle (Silver Top). Braidwood District. Goulburn District generally. At Marulan, Eucalyptus oil is distilled from this form (Peppermint). Kangaloon (White-topped Mountain Ash). Hill Top and Mittagong. Mt. Wilson. Mt. Victoria (Narrow-leaved Peppermint). New England (Messmate) The specimens from the last two localities are to all intents and purposes identical.

2. Var. *radiata* ("River White Gum").

Introductory.—We have a fairly distinct tree which goes under the names of "White Gum," "River Gum," "River White Gum," "Ribbon Gum," and even "Narrow-leaved Peppermint."

Its favourite habitat is on the sides of gullies, or on the steep banks of rivers, often some distance from the bed of the river or creek, but usually (perhaps always) on a well-drained slope leadin to a water-course. We have not observed the tree out of gullies.

It is often seen as a graceful sapling, but may attain the dignity of a large tree; in this Colony we have it up to 3 feet in diameter with a height of over 150 feet.

It has rather sparse, drooping foliage, which gives it, at times, something of a willow-like aspect.

Bark.—The appearance of the bark of this tree is worthy of careful record, to save confusion. It is nearly a White Gum when very young, but afterwards the bark of the upper part falls off in thin, long ribbons (hence the name Ribbon Gum), and the lower part of the trunk becomes covered, to a varying height, with fibrous bark of the character known to many as Peppermint bark.

We have not observed a tree of this variety falling strictly within the definition of White Gum, like *E. hæmastoma*, for instance; it is *nearly* a White Gum.

Sometimes, as observed near Mittagong, the lower part of the trunk of the River White Gum is of a thin scaly appearance; in trees say 12 inches in diameter, this scaliness would extend to 10 or 12 feet from the ground. This scaly appearance, which is not easy to describe, is intermediate in character between the scabrous bark of a Grey Gum *(E. punctata* or *propingua)*, and the thick scaly bark of a Bloodwood *(E. corymbosa)*. As these trees increase in size, the scaliness changes into that of a hard, fibrous "peppermint-like bark" character. The branches are quite smooth.

We draw attention to this matter, as two observers might possibly obtain two series of herbarium specimens agreeing in the minutest particulars, and one observer might report his tree smooth-barked *(Leiophloiæ)*, and the other half-barked *(Hemiphloiæ)*

The name given by the aborigines of the County of Cumberland, N.S.W, to the "River White Gum" used to be "Kayer-ro," according to the late Sir William Macarthur. This accurate observer writes of it—"Of no value for timber. A small, quick-growing species, very elegant when in blossom; is found only on the immediate sandy banks of rivers; the inner bark used for tying

grafts and for other similar common purposes." Subsequently Mr. Howitt points out that the aborigines of Gippsland similarly used the bark for tying and lashing, hence their name for the tree, "Wang-gnara," which signifies "bark-string."

Vernacular names.—Already dealt with.

Bark.—Already dealt with.

Seedling or sucker leaves.—The young stems have a rusty, glandular appearance, and the leaves are very narrow.

Mature leaves.—Dealt with below. (See page 607).

Although the leaves of this form are very thin, specimens from Bateman's Bay to Wagonga are especially thin. These specimens also have unusually narrow leaves.

Buds.—See page 607.

Fruits.—Large numbers (commonly 20 and more) in an umbel, borne on rather long, often filiform pedicels. They have a very regular, radiate appearance. Mostly pale coloured when dry. Very uniform in size, 2 to $2\frac{1}{2}$ lines (barely) in diameter, and pilular in shape. Sometimes they tend to close at the orifice.

Timber.—It is a white, fissile timber, rather tough when freshly cut, but afterwards of inferior strength. It is easily worked, but not durable on exposure. It is sometimes, we believe, fraudulently or ignorantly substituted for "Mountain Gum" *(E. goniocalyx)* in the Braidwood District, with disastrous consequences to the durability of the work in which it is used, and to the reputation of that undoubtedly valuable timber.

Range.—From Gippsland, through New South Wales, throughout the southern districts, at least as far north as the banks of the Nepean in the latitude of Sydney. Subsequent inquiry will probably find that it occurs further north. It is fond of valleys; we have it from such localities as Kangaroo Valley (between Moss Vale and the coast), and from Hartley Vale (near Mount Victoria). Our specimens from the Deua (Moruya) River and Tantawanglo Mountain connect with the Gippsland ones.

Botanical position.—Having described this Gum with some detail, we now proceed to enquire into its botanical position. There is no doubt that this "River White Gum," Bentham's variety *radiata* of *amygdalina* (B. Fl. iii. 203), and Howitt's form (*e*)* of *E. amygdalina* all come more or less satisfactorily under Sieber's *E. radiata*. A good deal of confusion has occasionally arisen in regard to the reading of Sieber's description. We give Don's translation of the original Latin in DC. Prod. iii. 218, Howitt's description of the Gippsland form, and Bentham's definition of var. *radiata*.

"E. RADIATA, Sieb.

"Lid of calyx hemispherical, mucronate, shorter than the cupula; peduncles axillary and lateral, rather angular, and rather shorter than the petioles; flowers 15-20 together in an umbel, on short pedicels; leaves linear-lanceolate, veins very fine, confluent at the apex, and forming a nerve, which is parallel with the margin.

"Fruit globose, 3 lines in diameter. Petioles 4 lines long. Leaves 4 inches long and 6-7 lines broad."

Mr. Howitt describes his form (*e*) as having:—*Leaves* narrow lanceolar falcate, attenuate at the stalk and pointed. Venation rather indistinct, the marginal vein considerably removed, and the lateral veins very longitudinal. *Umbels* on stalks as long or longer than the bud, the lid small and depressed, with a slight point. Buds numerous, 3 to 20. *Fruit* ovate-truncate, with slightly contracted orifice, compressed rather narrow rim, and small weak valves.

As described in the "Flora Australiensis," iii. 203, the "variety" *radiata* has leaves rather broader (than the type), 3 to 4 inches long. Flowers usually more numerous, sometimes nearly 20 in the umbels. Fruit almost pear-shaped.

E. radiata, Sieb.—*Leaves* linear-lanceolate, 4″ long, 6-7‴ broad, veins very fine, confluent at apex, forming a nerve, which is

* "The Eucalypts of Gippsland." Trans. Roy. Soc. Vic. Vol. ii. Pt. i. p. 86, and Plate 10, figs. 1-5.

parallel with the margin. *Pedicels* short. *Buds:* lid hemispherical, mucronate. *Fruit* globose, 3 lines in diameter.

Bentham's variety *radiata* of *E. amygdalina.*—*Leaves* rather broader than type, 3″-4″ long. *Fruit* almost pear-shaped.

Howitt's form (*e*) of *E. amygdalina.*—*Leaves* narrow-lanceolar, falcate. Venation rather indistinct. Marginal vein considerably removed. Lateral veins very longitudinal. *Pedicels* as long or longer than the bud. *Buds:* lid small and depressed, with a slight point. *Fruit* ovate-truncate, with slightly contracted orifice, compressed rather narrow rim, and small weak valves. (See his figure, *op. cit.*).

The "River White Gum" of N.S.W.—*Leaves.* The preceding (Howitt's) description applies very well. *Very* thin leaves. *Pedicels* rather long, often filiform. *Buds* nearly hemispherical; Howitt's description applies fairly well to this form. *Fruit* pilular (globose), very uniform in size (2-2¼ lines in diameter), sometimes tending to close at the orifice. (Pl. lvi., fig. 3.) Often pale-coloured when dry.

Above is a comparative statement showing partial and condensed descriptions of *E. radiata*, Sieb., Bentham's variety *radiata*, Howitt's form (*e*) (both of *amygdalina*), and River White Gum.

Sieber gives the breadth of the leaves at from 6-7 lines. Most are of about that breadth, others go up to 9 lines, while we have specimens from the Deua (Moruya) River which has leaves with the exceptional width of 1⅞ inches (nearly 14 lines!). Sieber gives the length of the leaves at 4 inches. These are too short as far as our River White Gum is concerned, leaves of 6 and 7 inches being common, while those of 5 inches at least are average ones. Sieber says pedicels *short;* those of the River White Gum are filiform and more than ordinarily long. He further gives the diameter of the fruit as 3 lines; we have never known it in the River White Gum to be quite 2½ lines, really a difference of some importance when we note how marked a difference in the appearance of a small fruit half a line or more in diameter makes. Nevertheless, after careful consideration of the matter, and examination of a large number of specimens, we are of opinion that Sieber's original *radiata* was taken from a River White Gum.

Then coming to Bentham's brief definition of variety *radiata*, he states that the "leaves are rather broader than type." He has probably followed in part Hooker ("Flora of Tasmania," p. 137) in his description of *E. radiata*:—"Leaves . . . rather small, usually 3 inches long . . . narrow, sometimes very much so, though not so narrow as *E. amygdalina* usually has them." We have already shown what is the average length of the leaves of the River White Gum. As regards the breadth, the leaves of the River White Gum are usually narrower (not broader) than those of typical N.S.W. forms of *amygdalina*. As regards the fruits, Bentham's variety is "almost pear-shaped." Here again Hooker is probably followed. The latter states fruits "turbinate or obconic, rather large." Neither in size nor shape does this correctly describe our River White Gum. As showing the difficulty of dealing with *E. radiata*, we may point out that (doubtfully) Hooker (*op. cit.*) quotes five forms of it in Tasmania alone. We would like to observe that Sieber's original specimen of *E. radiata* came from N.S.W., and not from Tasmania, and it would be well to modify Bentham's brief description in the directions we have indicated, and not to follow a description of the variety made from Tasmanian forms.

We have proved that our River White Gum does not entirely agree with Sieber's *E. radiata* nor with Bentham's var. *radiata*, and our tree is so well marked that had we decided that it was expedient to recommend the restoration of *E. radiata*, Sieb., to specific rank, we should probably have defined our River White Gum as a variety of the same. In that case, we might have called it *filiformis* in allusion to the pedicels.

But after careful consideration we have decided to continue the River White Gum as a variety of *amygdalina*, though not without doubt. Close affinity between the type and var. *radiata* is shown by the seedling or sucker leaves; the type species approaches it sometimes in buds, mature foliage and even fruits, while we have shown the River White Gum sometimes to have rough bark. We may, perhaps, at some future time re-open the question.

3. Var. *latifolia*, nobis.

3. Leaves on suckers opposite, *broad.*

Introductory.—This variety has broad, mature leaves also, as will be seen presently. We have decided to name it *latifolia* for the sake of precision. It has much in common with Howitt's var. (*b*) (*op. cit.*), and may prove to be so similar that it may be desirable to associate them under the same variety.

Vernacular names.—It is usually known as "Peppermint" throughout its range. It is called "Blue Peppermint" at Rylstone, "Messmate" in the Tumut, Wagga Wagga and Braidwood Districts, while we have received specimens from a small tree at Bungendore under the name of "Box Gum."

Bark.—Rough like a typical Peppermint.

Seedling or sucker leaves.—Comparatively broad; stem-clasping, more or less cordate at the base, and in some cases quite acuminate. The shape is brought out in the figure.

Mature leaves.—Broader and thicker than the preceding. An important characteristic is the strongly marked venation. On drying, the principal veins stand out in relief against the vascular tissue. Often shining, a characteristic best brought out in fully mature leaves.

The leaves of the "Blue Peppermint" (so called on account of their glaucous cast), from Mt. Vincent are not shining, neither are those from the "Messmate" or "Peppermint" from Delegate and the Snowy River. The leaves of the broad-leaved form of *E. amygdalina* from some other localities are nearly as dull in appearance. Dried specimens of leaves from the Delegate District are covered prominently with blackish dots, and the tissue of the leaf is channelled. The tips of the leaves are also sometimes hooked, all these points showing some affinity between this form and *E. stellulata* and *E. coriacea*, a subject touched upon under *Fruits.*

Up to 5 or 6 inches is a common length for the leaves, but they are barely 3 inches in some of the Bombala and Queanbeyan

specimens from ill-developed (?) trees; 4½ inches would appear to be an average length.

Specimens up to nearly 2 inches in width are found in the Mt. Vincent specimens; 1½ inch is a common width; 1-1½ inch may be given as the average width.

Buds.—Operculum usually blunt, though not quite hemispherical. Sometimes glaucous, as in the Wagga Wagga and Bell's Creek specimens.

Fruits.—With a greater tendency to pear-shape than any of the preceding, and the rim to be domed or arched (Pl. lvii., figs. 4-8). Usually shining. The tips of the valves occasionally a little exserted. The rims (mouths) usually red, a characteristic often attributed to *hæmastoma*, and the fruit itself often pale-coloured.

The fruits from Bell's Creek, and from Mt. Vincent, Upper Williams River, Cobark, and other high lands to the south of New England are sometimes more truncate than usual, but the arched or domed rim can always be traced in specimens from the same tree. Fruits from Bombala and Wagga Wagga are small, and have much the shape of those of *E. eugenioides*, but they are distinctly "domed."

There is a tree ("Messmate" or "Peppermint") of which we have herbarium specimens from Delegate and the Snowy River which has shiny, comparatively thick fleshy fruits which strikingly resemble *E. coriacea* fruits in miniature. From examination of fruits alone (or even perhaps of imperfect specimens of leaves which when mature are comparatively thick), an observer might readily name the tree *E. coriacea*, and we have suggested this as an explanation of "Peppermint" being given in the "Flora Australiensis" as one of the names for *E. coriacea*. The tree now under reference has the usual fibrous bark on the stem as ordinarily observed in *E. amygdalina*.

E. amygdalina and *E. coriacea* (not to speak of other species) are closely related species, and we express the opinion that they are perhaps most obviously related through the fruits and the leaves of our variety *latifolia* of the former species.

Timber.—The description of the timber of the typical form applies very well here.

Range.—The Dividing Range and its spurs from the Victorian border north and north-west at least as far as Byng in the Orange District, and Mt. Vincent (in the Rylstone-Mudgee District), also Cobark, Upper Williams River, and other places just south of New England.

Like other forms of *amygdalina*, much observation is still required in regard to its geographical distribution.

Specific localities are as follows:—Rob Roy; Delegate and the Snowy River; Tumut; Adelong; Wagga Wagga; Bombala (Quiedong); Queanbeyan; Braidwood; Bungendore; Mt. Vincent (watershed between Capertee and Turon); Byng; high lands, Upper Williams River; Cobark (near Mount Royal Range).

REFERENCE TO PLATES.

Plate LIV.

E. coriacea.

Fig. 1.—Normal leaf.

Fig. 2.—An average leaf of var. *alpina* (Mt. Kosciusko).

Fig. 3.—Another leaf of var. *alpina* (Mt. Kosciusko).

Figs. 4, 5, 6.—Fruits of *E. coriacea*, showing variation (4, from Cooma; 5, from Southern N.S.W.; 6, from Dubbo District).

E. stellulata.

Fig. 7.—A seedling leaf (from Quiedong, near Bombala).

Fig. 8.—Leaf of var. *microphylla* (from Mt. Victoria, Blue Mountains).

Fig. 9.—Cluster of fruits (from Kanimbla Valley, Blue Mountains).

Plate LV.

E. amygdalina (*typica*).

Figs. 1 and 2.—Twig and cluster of fruits from New England.

Fig. 3.—Seedling leaves.

Fig. 4.—Twig, with fruits.

Nos. 3 and 4 from Hill Top, near Mittagong. The leaves are comparatively small, narrow and coriaceous.

Plate LVI.

E. amygdalina (radiata).

Fig. 1.—Seedling leaves.

Fig. 2.—Specimens of mature leaves.

Fig. 3.—Cluster of fruits.

All from Hill Top, near Mittagong.

Plate LVII.

E. amygdalina (latifolia).

Fig. 1.—Seedling leaves.

Fig. 2.—Leaf of Blue Peppermint from Mt. Vincent, Ilford, near Mudgee.

Fig. 3.—Leaf from Tumut District.

Figs. 4-8.—Fruits, showing variation in arching of rim and general contour of fruit. No. 4 from Bell's Creek, Braidwood District; No. 5 from Cobark; No. 6 from Cobark, Nos. 5 and 6 from same twig, No. 7 from Mt. Vincent (Blue Peppermint); No. 8 from Tumut District.

STRAY NOTES ON PAPUAN ETHNOLOGY.

By C. Hedley, F.L.S.

I. The Cassowary Figure Head.

(Plate lviii., fig. 1.)

A distinctive feature of the carving of Eastern New Guinea is the prevalence of bird forms or their derivatives. Prof. A. C. Haddon devotes to the discussion of this subject a considerable section of his admirable essay on "The Decorative Art of British New Guinea."* Referring to the species depicted, he writes (p. 197):—"I have been unsuccessful in finding out what bird is intended; presumably it is the frigate bird, but this will not account for the frequent representation of a crest." In some instances he thought that a hornbill was recognisable, and quotes Forbes' unpublished notes that occasionally a cockatoo, and in the Louisiades a duck, was represented.

I submit that the evidence advanced below proves that the cassowary is sometimes figured, and suggests that it may be symbolised by the crested bird described by Haddon. On *a priori* grounds the cassowary, an important article of food, a source of valued bone tools, and as a dangerous quarry the theme of many a tale, would loom larger to the Papuan mind than the frigate bird. Again, if the conjoined bird and crocodile design be considered a scene, surely the last of all the fowls of the air to fall a victim to that reptile's rapacity would be the man-o'-war-hawk as sailors term the frigate bird. It is, however, within my own experience that the crane, a crested bird, may make a meal for crocodiles.

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* Royal Irish Academy. Cunningham Memoirs. No. x.

In July, 1890, I was visiting the village of Polatona, in Bentley Bay, near the eastern extremity of New Guinea. Outside the travellers' house where I lodged, there was planted in the sand of the beach a post about six feet high, carved and painted in red, white and black. It so attracted my attention that I made on the spot a pencil sketch, re-drawn on Plate lviii. My enquiries elicited that it was a canoe stem or figure-head, *geroma*, and that it had once belonged to one of the Chads Bay natives, hanged for the murder of Capt. Ansell.* It had probably formed a portion of one of the large native sailing vessels, whose hulls are built of several enormous planks sewn together.

An artistically executed bird's head surmounted the pillar. My colleague Mr. North, Ornithologist to the Australian Museum, kindly examined the original drawing, and in discussing it gave me the benefit of his expert knowledge. We agree that the ball placed under the beak and the buttress behind the neck are to be regarded as decorations additional to the original scheme; that the graceful and boldly modelled neck, the general shape of the head, and especially the crest, identify the bird as a kind of cassowary; further, that the line down the neck is an allusion to the brightly coloured space bare of feathers so conspicuous on that bird.

It was not to be expected of the savage artist that his work should afford exact specific recognition of the cassowary he portrayed. The only species recorded from this locality, *Casuarius picticollis*, Sclater, differs markedly by its flattened crest, and no known species, so Mr. North says, has a beak so pronouncedly decurved. But it is possible that a bird still unknown to science was copied by the Papuan craftsman.

The bird's neck issues from the gaping and toothed jaws of the conventionalised crocodile, the angle of whose mouth is carried up in a scroll to form a large eye. In Prof. Haddon's illustrations the usual attitude of the bird seems vertical to the plane of the crocodile; here, on the contrary, it is horizontal. Below, the post

* Thomson; British New Guinea, p. 34.

was adorned by a pattern usual in that locality, white zigzag lines on a black ground divided the space into panels filled by a white scroll on a red ground, such as Haddon regards as degenerate and conjoined birds' head. Each panel may possibly typify a crocodilian scute, and certain forwardly directed loops which terminate the carving may even stand for hind limbs in a state of extreme degeneration and reduplication.

II. The Palm Leaf Creel.

(Plate LVIII., fig. 2.)

From its perishable nature this useful domestic utensil is unlikely to have reached a niche in the Ethnological Collection of any Museum. The only mention I have noticed of it in literature is by Lieut. Boyle T. Somerville, who, writing on the New Hebrides, observes* :—"The coconut palm leaf is very ingeniously woven in all the islands by plaiting together the long tongues of the frond, beginning at the rib and joining the tips. A mouth is made by splitting the rib down the middle, and thus a very capacious basket, with a mouth fitting as tightly as a purse, is quickly made. Pigs, yams, &c., for sale are usually carried in them." As I have seen no published illustration of this basket, this opportunity is embraced of submitting a sketch made in July, 1890, in a native hut in the village of Mita on the north shore of Milne Bay, British New Guinea. Here they were called *Porha*, and were the exclusive property of the women, who easily manufactured them by doubling the split half of a coconut frond, threading the pinnæ under and over in a darning pattern, gathering their ends together and knotting them; the rim being supplied by the split rachis. So much were these associated with women's drudgery that the men considered it quite undignified for them to touch one. A youth whom I commissioned to bring me a specimen to draw, amused me by carrying the offensive article at arm's length and flinging it down before me with an expression

* "Journal of the Anthropological Institute, xxiii., p. 378.

of disgust. A pretty scene every evening in an Eastern Papuan village is a file of women wending their way by the forest path home, each bending under a porha full of fifty or sixty pounds weight of fire-wood or garden produce. The basket is laid across her shoulders somewhat as a North British fisher lass carries her creel of fish, but instead of being slung the porha is caught by the rim in the crook of the porter's fingers.

Postscript.—Since writing the above I have been favoured by two veteran missionaries and accomplished ethnologists with the following additional information.

The Rev. Dr. W. Wyatt Gill tells me:—

"This is the common food-basket throughout the South Pacific Islands, and no doubt it is the same in the North Pacific, too. At Mangaia, it is called 'r a u r a u' = 'leaflet-leaflet' (*i.e.*, of the coconut palm). At Rarotonga it is the 'k i k a u.' Now, 'k i k a u' is the name for the coconut leaf or frond. So although a food basket is made from only a part of a frond, it bears the same name as the whole. There are plenty of parallels to this in our own language, *i.e.*, a 'sail' for a 'ship,' &c., &c. At Aitutaki, it is called indifferently 't a p o r a' or 'k e t e.' 'K e t e' means basket in general. Mangaia, Rarotonga and Aitutaki are the three chief islands of the Cook's Group. I have seen exactly the same food baskets at Tahiti and each of the Leeward Islands (now French) as far back as 1852. Their name is 'e t e' (*i.e.*, the 'k e t e' of the Cook's Group) I believe."

The Rev. S. Ella writes to me:—"Your drawing of it is a good sketch, only needing the knotting together of the leaflets (pinnæ) to form the bottom. It is the commonest kind of basket used, and is easily and quickly made, the material, the upper end of a coconut leaf, being always at hand. It is not so remarkable that it should be so generally used throughout Polynesia, and in almost exactly similar form and construction, when one considers its simplicity almost self-suggestive, and the general abundance of the materials; women and children make them with ease. Your description of its construction is correct. It is employed for

common purposes, carrying of taro, yams, husked coconuts, fowls, fish, &c.

"From the coconut leaf mats for placing cooked food before the eaters are formed, also blinds or enclosures to native houses, thatching for outhouses and fans. The plaiting in this case being made a little closer.

"The name of this coconut basket in Motuan (British New Guinea) is 'b o s e a'; in Uvean (Loyalty Islands) 't a n g l e n-'nu'; in Aneityumese (New Hebrides) 'b u r a b u r a,' or with the article prefixed 'n a b u r a b u r a'; in Samoan (Navigator Islands) and cognate dialects 'a t o l a u - n i u.'

"The better class of baskets are formed from the pandanus leaf, or dressed fibre of the native hibiscus. These are more durable and carefully preserved, made in various shapes and sometimes ornamented with beads, feathers, &c. The coconut leaf basket is thrown away after it has served its purpose for the occasion."

ON APPARENTLY UNDESCRIBED STRUCTURES IN THE LEAVES OF CERTAIN PLANTS.

By Alex. G. Hamilton.

After this paper had been read it was discovered that similar structures had been described by Lundström as "Acaro-domatia." (Pflanzenbiologische Studien. ii. Die Anpassungen der Pflanzen an Thiere). By the permission of the Council the paper has been withdrawn in order that Lundström's important work may be taken into consideration.

NOTES AND EXHIBITS.

Mr. Steel exhibited a vivarium containing six or eight specimens of the N.S.W. Peripatus with their progeny, about thirty-six young, born within the past fortnight, after the mothers had been in captivity for about 10 months. The exhibitor stated that he had had the pleasure of witnessing the natural birth of numbers of these young. In the same vivarium was a young Peripatus, the survivor of a number born 10 months ago in captivity. Mr. Steel also showed the nodule from Macdonnell Ranges exhibited at last meeting, which had been identified by Mr. Cooksey, of the Australian Museum, as an obsidian bomb; and a little volcanic bomb from one of the small extinct volcanoes near Auckland, N.Z., where they are common, of all sizes.

Messrs. Maiden and Baker exhibited a series of botanical specimens in illustration of their papers.

Dr. Broom sent for exhibition specimens of the bone breccia from Taralga, with the lower jaws of the fossil Marsupials described by him, *in situ*.

Mr. Hamilton sent for exhibition a series of fresh leaves of a number of plants in illustration of his paper.

WEDNESDAY, MARCH 25TH, 1896.

The Twenty-Second Annual General Meeting of the Society was held in the Linnean Hall, Ithaca Road, Elizabeth Bay, on Wednesday evening, March 25th, 1896.

The President, Mr. Henry Deane, M.A., M. Inst. C.E., F.L.S., &c., in the Chair. The minutes of the previous Annual General Meeting were read and confirmed.

The President then read the Annual Address.

PRESIDENT'S ADDRESS.

It was with very great diffidence that I accepted last year the honourable position which you thought fit to confer upon me. It seemed to me that the man who was selected to stand at the head of such an important Society as this should be one, who, if not actually professionally engaged in matters connected with the science of biology, had sufficient leisure to permit of his devoting a large amount of his energies to the subject.

As you are, perhaps, aware I have for some years past found my time both in and outside office hours so much engrossed in matters pertaining to my profession, that the actual scientific work that I am able to carry out is very small. You may therefore suppose that the preparation of an address of this description is to me no light task, and I am sure you will accord me some leniency, if it falls below the average of the able addresses which my predecessors in this chair have accustomed you to.

At the outset I may remind you that to-day we commemorate the Society's coming of age. On the 13th of January, 1875, in a rented room in Lloyd's Chambers, 362 George Street, the Society held its First Annual General Meeting, and on the 25th of the same month the First Monthly Meeting for the reading of papers and the transaction of scientific business. In the history of a corporation this may not be an event of such importance as it

is to the individual; still it marks the fact that infancy and childhood so to speak are safely passed, and the difficulties connected with the early growth of a Society successfully combated.

The history of the Society has quite recently been so fully dealt with in the Introduction to the Macleay Memorial Volume, that I need not go into it on the present occasion, but there are a few matters connected with the work of the Society to which I will briefly refer.

There is the increasing responsibility which, more especially in respect to financial matters, ever since Sir William Macleay's retirement from active work, has devolved upon the Council. Up to the time mentioned Sir William Macleay relieved the Council of such burdens. Nevertheless the harmony which characterised the meetings of those days continues undisturbed, and the desire of the members to cope fairly with the greater responsibilities is evidenced by the high average attendance of members at the meetings. This development in the financial aspect of the Council's work is one which should be allowed due weight in the selection of members to sit on the Council. The claims of the scientific aims of the Society to be represented are not in danger, as we have many active members ready to look after its interests in this respect. The endowment fund, lately increased by the addition of the Bacteriology Bequest, amounts to over £30,000. To invest wisely and to keep wisely invested so large a sum, the duty of which devolves on the Council, requires the selection of a fair proportion of members skilled and experienced in financial matters.

The Proceedings of the first two years of the Society's work were issued as Volume I. In the course of the next few weeks the publication of our twentieth volume will be completed. While a high average of value has been maintained we have, in amount of matter published annually, outstripped most of our sister Societies in Australasia, and our ability to do this we owe to the beneficence of Sir William Macleay.

In his address last year my predecessor, Professor David, furnished full particulars of what, it was supposed, was the final settlement—so far at least as this Society was concerned—of matters relating to the late Sir William Macleay's bequest for the endowment of a lectureship in Bacteriology. It was with some surprise, therefore, that in July last the Council received from the Senate of the Sydney University an intimation of its intention to relinquish the bequest, and to return the money to the executors. This was subsequently done, and the money paid by the executors into Court. On October 15th, 1895, on the petition of the Society, the Chief Judge in Equity made an order for the payment to the Society of the sum in question, less costs, namely, £12,704. This amount represents Sir William's original bequest of £12,000, less legacy duty and law costs, plus interest accruing on fixed deposit from the time of the receipt of the money by the University until that of its repayment to the executors.

It devolves upon the Council, as the managers of the Society's affairs to provide for the investment and to keep invested the money to the best advantage; and out of the income to pay a competent Bacteriologist, and provide and maintain a suitable laboratory and appliances.

The clause of the Memorandum attached to Sir William Macleay's will is as follows:—"Should the Senate decline all or any of these conditions I empower my executors to hand over the aforesaid sum of twelve thousand pounds to the Linnean Society of New South Wales to provide a sufficient salary by the year to a competent Bacteriologist who shall be called the Bacteriologist to the Linnean Society and whose duties shall be to conduct original research in the Laboratory of the Society and to give instruction to one or two pupils at the discretion and under the orders and control of the Council of the Society any surplus to be applied to laboratory requirements."

Thus it will be seen that the Council is left with discretionary powers in fixing both the amount of the Bacteriologist's salary, and the date of his appointment. In determining the first of these points, the Council has had to be guided by the

amount of the annual income which the principal may be expected to yield. Now this, in consequence of the serious depreciation in value of all sound income-producing investments which has become so marked a feature in our commercial life since Sir William made his will (in December, 1890), is, I regret to say, likely to be for some years to come a sum considerably smaller in amount than Sir William contemplated would be available for the purpose.

Then as regards the date of the appointment. Since without a suitably equipped laboratory the Bacteriologist cannot carry on the work he is specially to be appointed to do, it is evident that the arrangements for providing the former must progress something like *pari passu* with any scheme for filling the post of Bacteriologist. Before any research can be entered upon, provision must therefore be made for an initial expenditure of something like £700 for equipment and incidental preliminary expenses—or more than one year's income. The necessity for proceeding slowly and with caution led to the Council's appointing a sub-committee to consider generally and report on the best way to give effect to Sir William Macleay's wishes. On presentation of this report it was carefully considered by the Council, and with some slight modifications it was adopted. The result is that the Council has decided that, provided a suitable investment can be met with at a rate of interest not lower than the then current rates, the appointment might be made so as to take effect at the close of the hot season of 1896-97, provided also that a competent Bacteriologist can be engaged on what are practically the terms and emoluments offered to University Demonstrators.

Besides a further postponement of say one year, two, or even three years should circumstances seem to demand it, there is yet another alternative, namely, to make an indefinite postponement with a view to a very substantial accumulation of interest to be added to principal. Against this course it may be urged that on general grounds it is desirable that as soon as circumstances permit the appointment of a Bacteriologist should be proceeded with;

and that already nearly four years have elapsed since the principal became available. And while on the one hand the Council does not expect to attract an eminent European Bacteriologist to the Colonies—nor could Sir William have contemplated such a contingency; yet on the other hand the Council is not altogether without hope that it is possible to find a thoroughly competent and enthusiastic Bacteriologist, animated with the true scientific spirit, who will appreciate the prospect of carrying on original investigations under very favourable circumstances.

With satisfaction may be noted the pleasing evolutionary development in the scope of the Society's scientific work. At the outset this was exclusively zoological. In the Second Annual Address of the first President (Sir William Macleay) the hope was expressed that at no distant date contributions from botanists and geologists would find a place in the Proceedings. Sir William lived to see that hope amply fulfilled. Animal morphology also has become an important feature of the Proceedings. One would be glad to see the morphology of plants commanding a portion of the attention it deserves, but the outlook is not a promising one in that direction anywhere in Australia. The subject apart from that of Bacteriology, languishes at present for want of students for the conditions for their encouragement here are wanting. It would be well if we had even a small edition of such a botanical laboratory as that at the Botanical Gardens at Buitenzorg, Java, so ably presided over by Dr. Treub, and so liberally provided for by the Dutch Government.

Since the last Annual Meeting our numbers have been diminished by the deaths of one Honorary and three Ordinary Members. Professor Sven Lovén, the eminent Swedish naturalist, died on September 6th last at the advanced age of 87. Since 1841 he had filled the appointments of Professor and Conservator of the Royal Museum of Natural History, Stockholm. He devoted much study to the marine fauna of the Baltic and the North Seas, special attention being given to Echinoderms. Professor Lovén was elected an Honorary Member of this Society in 1891.

Of the Ordinary Members, two—Dr. Paul Howard MacGillivray and Mr. J. Bracebridge Wilson—were resident in Victoria. They have strong claims to be held in grateful remembrance by Australian naturalists Dr. MacGillivray belonged to a family of naturalists. His father was Professor of Natural History at King's College, Aberdeen, and his brother, the late John MacGillivray, was author of the "Voyage of the Rattlesnake." Since 1857 Dr. MacGillivray had followed the practice of his profession in Victoria, at the same time showing himself a public-spirited citizen much interested in the spread of knowledge and culture. Much of his leisure for many years was devoted to the study of Australian Polyzoa, and he was the author of an important series of papers thereon, contributed to the Proceedings and Transactions of the Royal Society of Victoria, or to Professor McCoy's Decades. These date from the year 1859. His important "Monograph on the Tertiary Polyzoa of Victoria" was passing through the press at the time of his death, and has since been published.

Mr. J. Bracebridge Wilson, M.A., F.L.S., who died on October 22, aged 67, was for many years Head Master of the Church of England Grammar School, Geelong. Like Dr. MacGillivray, he was a busy professional man, whose leisure was given up to Natural Science, out of pure love for it. In utilising his yacht in dredging and trawling he found his hobby. This was done in a scientific systematic way, with the object of accumulating stores of well-preserved material for the elucidation of the marine fauna of Port Phillip by specialists, he himself sharing in this part of the work as far as opportunity served.

Nearer home we have lost, at the early age of 30, one of the younger school of naturalists—Arthur Sidney Olliff, who died December 29th last. Mr. Olliff came to New South Wales in February, 1885, to take up the work of Assistant Zoologist, in the Division of Entomology, at the Australian Museum, where he remained until his appointment as Entomologist to the Department of Agriculture, Sydney in 1890. He had been for some time in enfeebled health, and shortly before his

death he had in contemplation a visit to England in the hope of benefiting by the change. Many of his papers on Lepidoptera and Coleoptera will be found in our Proceedings. An appreciative notice by one of his colleagues, together with a complete list of Mr. Olliff's papers, has appeared in the Agricultural Gazette, Vol. vii. Part 1 (Jan. 1896).

The year 1895 is especially memorable by the deaths of Huxley and Pasteur, two of the foremost leaders in Science. They occupied so prominent a position in the scientific world that their loss has been truly felt to be of world-wide importance. In the Journals and Magazines of the countries on both sides of the Atlantic have been published numerous well-merited eulogies of their lives and work, written from very varied standpoints, and in many cases based upon special or personal knowledge. As they are within reach, and have probably already come under your notice, I should be at a disadvantage in any attempt to touch further upon themes which have already evoked sympathetic and appreciative treatment from those best qualified to speak.

I propose now to say a few words on the subject of Forestry—the importance of which is much underrated.

Our forests have been left hitherto very much to themselves, the idea being that as Nature has looked after them in the past so a kind providence will continue to do so in the future. The fact is overlooked, however, that with new conditions of settlement the chances of shapely young trees growing up to replace those removed are reduced to a minimum; and so, as has occurred in other countries, the depletion will go on till sooner or later a feeling of alarm arises and the necessity for commencing the work of afforestation is recognised, and the task has to be undertaken at a much greater cost than if time had not been lost.

The ignorance of the benefits to be derived from proper management of the forests is very remarkable. We are possessed of timber which in strength and durability can vie with the products of all the world, and a large revenue could be made out of it. Forestry is, as has been happily said by Professor Bailey Balfour,

a division of rural economy which ought to be the basis of a large national industry.

It is under this aspect that we have chiefly to consider it, and though we may look upon the conservation of our forests with respect to their influence upon health and climate, and upon the soil itself, we are perhaps still more interested in them as a possible source of direct commercial profit on account of the valuable material they furnish.

On the other hand we must not forget that they confer an indirect benefit by protecting the soil and altering the conditions of temperature.

Much lasting injury is done to forests by allowing the pasturing of sheep and cattle in them. Young seedlings which should take the place of those cut down are trampled, browsed down or otherwise so bruised and injured as to be worthless.

Firing of the undergrowth is an evil which is much misunderstood. It is often done by settlers to promote the growth of grass; the fire spreads outside the limits of their land, and much devastation follows. The immediate effect is not only to destroy the promising young growth, but also to char the humus and spoil the fertility of the soil.

It will be well to consider shortly the climatic and hygienic influence of forests. For those who wish to investigate the matter in some detail, I would recommend the perusal of a pamphlet published by the Forestry Division of the United States Department of Agriculture in 1893, entitled "Forest Influences." We have here a series of reports on the different branches of the subject, and there is an able summary of the whole case by Mr. B. E. Fernow, Director of Forestry. As the results are undoubtedly applicable to a considerable portion of this colony, I will refer to them in some detail.

Two classes of effects are to be noticed—namely, those on the general climate and those on the local climate. When we build a house we alter the temperature and humidity conditions of the space covered, and so it is with forest cover, but the question

arises can we alter the conditions on a larger scale by alternating forest and field, or by preserving intact large areas of forest?

In reply to this query, it seems to have been shown by the forest planting at Lintzel that a considerable change in the meteorological conditions resulted.

Forest cover causes obstruction to the winds and hinders the action of the sun's rays upon the soil. A difference in temperature and evaporation outside and inside the forest area then arises. When the areas of the different kinds are large enough, local currents of air will be set up, which will cause the interchange of conditions between the two areas. The size and character of the forest growth, density, height, situation and composition are the factors which determine its influence. It is not trees but masses of foliage that do the work.

On water supply the effect of forest is undoubted. The soil acts as a sponge from which the water runs off gradually; remove the forest wholesale, and the water rushes along, tearing away soil and flooding and injuring growing crops.

Irrigation is generally advocated for arid regions alone, but it is also particularly serviceable in well watered regions, and here, as above shown, forest cover materially assists.

The following observations are of interest:—

First, as to the difference of conditions within and without the forest. On the average the forest is cooler than the open country in summer, but about the same in winter, with a warming effect in spring, and the evaporation is only one-half that in the open.

The percentage of rainfall evaporated is about 40% in the open and about 12% in the forest, taking the whole year.

The total quantity of moisture returned into the atmosphere from a forest by transpiration and evaporation from the trees and the soil is about 75% of the precipitation; other forms of vegetation give from 70 to 90%; bare soil gives only 30%. Gauges in European forests catch 75 to 85% of the rainfall, the rest runs down the trees, is intercepted or evaporated.

The experience of increased rainfall over the station at Lintzel with increase of forest area points strongly towards interdependence.

Secondly, as to the influence of forests upon the climate of the surrounding country.

Any effects that arise must either take place by diffusion or by means of local air currents, or from the fact of the forest acting as a windbreak.

Deforestation allows of the uninterrupted sweep of winds over the country, the evaporating and parching effects being much more intense than those resulting from mere dryness of the air. This class of effect is, of course, worse in flat country and on the seashore.

When moisture-laden winds pass over cool areas of forest the possibility of condensation is at least not reduced, whereas heated plains certainly do reduce it. The presence of large forests in Asiatic and European Russia has been shown to produce a sensible effect in lowering temperature.

In general we may expect that an alternation of large forested and unforested areas in regions which on account of their geographical situation have a dry and rigorous climate is more beneficial than large uninterrupted forest areas which would fail to set up that local circulation which is brought about by difference of temperature and permits an exchange of the forest climate to the neighbourhood.

The results of systematic observations in forest meteorology made in France, Germany, Sweden, Austria and elsewhere, and extensive observations on temperature and rainfall extending to Russia and India are given in the Report.

It seems scarcely necessary to mention the sanitary effect of forests. As is well known, trees have been planted with success to absorb the moisture of swamps, and the exhalations of eucalypt trees are particularly beneficial in counteracting malaria.

The idea that our forests may get exhausted is often jeered at, and figures have been brought forward to show what an enormous and practically inexhaustible supply of timber exists; yet in other

countries with still larger supplies a panic has arisen. The more rapid depletion of our forests for purposes of export is constantly being urged as if we had there, without any trouble on our part, an unfailing source of revenue. By all means let us export, but let us first take steps to replace what is taken away and insure the future.

Some months ago, as the result of a communication which I addressed to the Minister for Works protesting against the exportation of ironbark, a return was prepared by the Forest Branch purporting to show that the forests of this colony would supply over 167½ millions of sleepers, which sounds like an enormous quantity. An examination of the return shows that two-thirds of this quantity is to be obtained from the forest reserves in the Casino and Glen Innes districts, that of the former being reported to cover about 4000 square miles and the other 2000 square miles. Those estimates seem large, and it is curious to note that when the Glen Innes-Tenterfield railway was being constructed the prices paid for stringy bark sleepers was 6s. 6d., while 7s. each was paid for ironbark. This does not look like an abundant supply. It is one thing to have trees scattered through a forest, and another to get them out at reasonable cost.

Assume, however, for the moment that the above quantity of sleepers is obtainable, and that instead of many of them being locked up in almost impenetrable gullies they are obtainable at a small cost, what is likely to be the future demand? Our own requirements for sleepers are at the rate of 2400 per mile, and 1000 miles would only require about 2,400,000 sleepers, but all Australians must hope that with the development of the country, many thousand miles of new lines will be required, and then we have to provide for renewals. Now suppose in addition to our own requirements we foster trade with other countries. In the United States of America there are 180,000 miles of railway. They put their sleepers much closer together than we do, so that they require 3000 to the mile at least. The timber used at present is pine or white oak, the best of which only lasts ten or twelve years. What, if our American friends were really to take

a fancy to ironbark, could we supply their wants? The number required to fit up all the lines would be—say, 540 millions, so that we should only have a third of that quantity, neglecting our own requirements. England and Europe, too, possess an enormous mileage, and might come upon us for supplies; but, as is seen, we simply could not meet them. Then what right have we to talk about encouraging a large export trade until we take steps to increase the natural productiveness of our forests?

In another State Report of the United States Department of Agriculture—namely, that on the "Forest Conditions of the Rocky Mountains, 1889"—there is a paper by Dr. E J. Janus, which is remarkable as bearing upon the question of the value of forest culture which is so much neglected or ignored. It is scarcely necessary to remark that the Rocky Mountains are the home of some of the principal mining industries in the United States, and are in the centre of an arid region which, except for the streams arising from the melting of the snow on the heights, has little water to depend upon. Therefore, Dr. Janus' observations, which are made with special reference to this region, are particularly worth attention :—

"The forests of any large country bear a peculiar relation to material prosperity. They not only constitute a large proportion of the national wealth of a nation, but they form the independent basis of a flourishing agricultural, manufacturing and commercial industry. They are, moreover, one of the most important elements in determining the climatic condition of any given region, and through these the distribution of population, of industrial pursuits and of disease and health." He goes on to say that "the value of the forests is greater than all the metals, coal, petroleum, stone, and all the steamboats, vessels, &c., plying in American waters and belonging to citizens of the United States." He complains that practically nothing is done to protect or to cultivate, a statement which equally applies to this country, and yet three-quarters of the population use wood as a fuel. In the Australian bush there is at present an apparently unlimited supply of fuel, yet the scarcity of it in the neighbourhood of the larger towns

and centres of industry like Cobar and other mining districts is already painfully felt.

There is an impression that forestry does not pay. There is certainly no greater mistake. The experiences of other countries prove it. I find that in 1884 in Baden the area of the State forests was 234,000 acres, producing a net return of £120,000 annually; in Württemburg the area was 476,000 acres, and the profit derived was £237,400; while in Saxony, with a forest area of 408,000 acres, the net return was as high as £330,000. Perhaps some might argue that although forests would pay in Europe, under the different conditions prevailing here they would not; but a little consideration will show that the conclusion is not warranted. If our hardwood trees grow more slowly—which is, however, not the case, at least on the coast—the produce is of higher value; and in the interior, where from lack of moisture they do grow slowly, the rental value of land is much lower. It can, I think, be easily shown that forest cultivation on areas which do not furnish abundant grass or herbage would produce at least five times as much income from timber as from grazing. Of course the Government would have to keep control of the timber, and not merely for a small fee give a man a license to destroy or cart away as much as he likes.

Professor Bailey Balfour, in his Address to the Biological Section of the British Association in 1894, gives an interesting example of a piece of ground at Nover in Rossshire, which was worth from one to two shillings grazing rent. This land was planted with trees, and after 61 years of growth was clean cut in 1883. The net yield of the land over this period was equal to an annual revenue of nine shillings per acre per annum.

There are cases given in the United States Reports of worn-out sandy land being planted with trees and yielding a profit of twelve shillings and sixpence per acre per annum when cut for fencing posts.

Forest conservation means not that no trees shall be cut down, but that the forests shall be cultivated as any other crop, and not wasted. Steps should be taken to prevent the spread of fire

and the browsing of animals of all sorts on growing forests. This is of the utmost importance.

The matter is one generally for the State to take up, yet there are immense tracts under private control which would pay better as forest than as grazing land, and if proper instructions could be given, suitable schools of forestry instituted, men could be trained both for the employment of the State and to assist private owners. Land owners would be taught to see that it is in the interests of their property to plant and conserve, for the existence of young plantations even, which only their followers will reap the full benefit of, will mark the growth of, to them, an important asset.

In many parts of Europe the organisation for the control of the forests is most excellent. Perhaps of all countries Switzerland is the most advanced. The Reports of United States Consuls, 1887, give some most valuable and interesting information under this head.

Forestry is not only a matter of vital interest as to poor lands, but the reclamation of waste lands can be made profitable. I find it mentioned in another United States Report that in 1885 there were 10,000 acres of thriving forest on Cape Cod planted 30 years before on sterile sands, and extensive woodlands similarly planted at Wood's Hill; on the other hand, other places that have been denuded have become barren.

On the shores of the Bay of Biscay dunes once stretched over a hundred miles in extent. Sands were driven up the slopes, forming dunes from 100 to 300 feet above the limit of the sea, and moving inland they carried great desolation. Bremontier, a century ago, persuaded the French Government to allow him to experiment, and now there are over 100,000 acres planted with maritime pine, blocking the sea out. The land at the back which was formerly useless is now cultivated, and not only are the hygienic results most remarkable, but the French Government derives a revenue of 180,000 francs from the timber.

In connection with this subject I have endeavoured to obtain some data as to the rate of growth of trees, and the period at which maturity is reached in Australia as compared with Europe. In Europe numerous observations have been made which are given in the above-mentioned Consular Reports. It is stated that trees are allowed to grow as follows :—

Red beech	120 years
Oak	160 „
Elm, ash and maple	80 „
Birches and alders	60 „
Other species	40 „
White fir	100 „
Pine and fir	80 „
Larch	60 „

Growth in height and girth is most rapid up to 40 or 50 years, after which the rate declines. The increase in bulk, however, proceeds at an increasing rate, as might be expected, seeing that the roots are constantly spreading.

It is much to be wished that systematic observations on the growth of trees, native and exotic, should be made in Australia; but it would appear from the information obtainable that it is, under fairly favourable circumstances, at least equal to that in Europe.

The late Rev. J. E. Tenison-Woods* thought "that the tallest trees of the forest, the giant timber of Tasmania, range from fifty to seventy-five years old."

The late Rev. Dr. Woolls† says "whatever may be the ages of the Tasmanian Eucalypts, I believe that the harder woods in the County of Cumberland are slow in growth, and that centuries elapse before they reach their full proportions."

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* "Tasmanian Forests." Journ. and Proc. Roy. Soc. N.S.W. 1878. xii. p. 22.

† Proc. Linn. Soc. N.S.W. 1880. v. pp. 508-509. See also the same author's "Contribution to the Flora of Australia" (1867), pp. 220-221; and "Lectures on the Vegetable Kingdom" (1879), p. 93.

This does not quite agree with my own observations.

Both in the "Eucalyptographia" and in the "Select Extra-Tropical Plants" (Ninth Edition, 1895), Baron von Mueller has supplemented his own experiences with a considerable amount of information from other sources. The Baron considers that *E. globulus* "is, among evergreen trees, of unparalleled rapid growth." And of *E. amygdalina* he says that "plants grown on rather barren ground near Melbourne have shown nearly the same amazing rapidity of growth as those of *E. globulus*." The following instances relating to extra-Australian localities are selected from a large number quoted by the Baron:—In eight years in the south of France *E. amygdalina* attained a height of 50 feet. *E. globulus* in Jamaica attained a height of 60 feet in seven years; in California 60 feet in eleven years; in Florida 40 feet in four years (stem-diameter 1 foot); in the Neilgherry Hills 30 feet in four years (one tree, twelve years old, being 100 feet high, and 6 feet in girth, at 3 feet from the ground). Near Pretoria the same species "attained a stem-circumference of $9\frac{1}{2}$ feet in 22 years"; and "in Algeria and Portugal it has furnished railway sleepers in eight years, and telegraph-poles in ten years."

Mr. H. C. Russell, F.R.S., the Government Astronomer, supplied some particulars in some notes read before the Royal Society of N.S. Wales in 1891, and these he has kindly supplemented with later information.

The trees measured were Eucalypts, growing at Mt. Victoria, and Lake George, and others planted in Observatory Park.

At Lake George one of four young trees was selected for measurement in January, 1885, when its girth three feet from the ground was found to be 23 inches. On 10th November, 1891, its girth was $52\frac{1}{4}$ inches; on 22nd November, 1892, it was $54\frac{1}{4}$ inches; on 1st January, 1894, $60\frac{1}{4}$ inches; and in January, 1895, $63\frac{1}{4}$ inches.

Other trees have been marked since the notes above-mentioned were made, and the results will be watched with interest. At Mt. Victoria on barren ground, about fifty years after Sir T. Mitchell had cleared one of the hills for survey purposes, the trees

were found to have grown up again, attaining a diameter of 15-20 inches; after fifty years' growth the girth was about 63 inches. In Observatory Park specimens of *Eucalyptus globulus* grew to 41½-46 inches in circumference in 16 years. Some examples of *Pinus insignis* of the same age were measured in November, 1891, and were found to be from 31½ to 35½ inches in circumference 3 feet from the ground. The situation, however, Mr. Russell says, does not suit this species of tree, so that of course under favourable circumstances the growth would have been much greater.

I have obtained from Mr. Bray, Police Magistrate of Murwillumbah, who has had long and valuable experience in the "bush," some particulars as to the growth of red cedar, *Cedrela australis*, and other trees. He says, writing to Mr. Caswell:—"I have seen a cedar sapling about one foot in diameter and, I should say, 3 or 4 years old, grow into a tree 3 feet in diameter (20 feet from the ground) in 17 years." "It is very hard to tell when a tree has matured, but from what I have seen of different trees, I should say that most of the 'scrub' trees would grow into good timber and to full size in 25 years." As to the number growing per acre, he adds, "I once felled 38 cedar trees on one acre of land; all these were large trees, none less than 3 feet in diameter, 20 feet from the ground. This was up near Tyalgum." "Some of the very large cedar trees that I have seen here must have been very old—perhaps 100 years."

Mr. Gill, Conservator of Forests at Adelaide, found poplar, pine and oak grown at the Botanic Gardens, Adelaide, to be of good convertible size after 30 years. At Mount Gambier *Pinus insignis*, after 30 years, fetched fifty shillings. Mr. Gill is of opinion that whereas trees in Europe take 60 to 120 years to mature, they will take only half that time in Australia. Specimens of *Eucalyptus globulus*, after 17 and 18 years, produced telegraph poles 25 feet long, each from 8 to 10 cubic feet in measurement. The trees were from 50 to 60 feet high. *E. corynocalyx* (sugar gum) grew after 14 years to a height of 68 feet—a bottom log 12 feet long, containing 11 cubic feet, was cut

out. The timber of this species is now accepted as teredo-resisting, and is being largely planted under Mr. Gill's directions. Mr. Gill says:—"To give you some little idea as to size of timber grown within 20 years, I may state that poles lately cut by me for telegraph purposes, and disposed of to the Telegraph Department, measured 26 feet 6 inches long, and were 7 in. to 8 in. top diameter, and 11 in. to 14 in. bottom diameter. They contained from 8 and 9 to 17 and 18 cubic feet of timber, and this is irrespective of other parts of the tree, which generally totalled from 60 to 70 (or even over) feet in length."

It is apparent from the above that where the climate is favourable the growth of trees is quite sufficiently rapid to justify large expectation of profit. In the interior growth is necessarily much slower, but must still be noticeable. The comparative rate of growth, as compared with trees on the coast, may be assumed to be roughly proportioned to the moisture of the ground, all other things being equal; and it is, therefore, probable that an ironbark in the climate of Dubbo (250 miles from the coast) will take twice as long to grow as the same species where the rainfall is twice as great. Of course this is only surmise, and accurate observations are required.

It is, however, perfectly clear that if on the forest land of the eastern slopes of the main range, where such land might be worth one shilling per acre for grazing purposes, it will pay to grow timber; then in the interior, near the railways, the poor ridges, which are not worth one penny per acre, would if put under cultivation for trees yield a very handsome profit indeed; but it must be understood that this expectation can only be realised if care is taken in growing the trees. They must be started in nurseries, planted out, and, until they have grown to a considerable size, must be properly fenced off and protected from the browsing and ravages of animals and man. Strict measures must also be taken to preserve them from injury or destruction by bush fires.

It is certain that if proper measures were taken a profitable industry could be carried on, giving employment to large numbers

of men. I find that some years ago in Switzerland, where, as above stated, the State management yields a large revenue, there were employed on the forests 5,851 persons, including 150 trained forestry officials and from 1,500 to 2,000 foresters and overseers, the area of forest being 1,940,659 acres.

It is impossible to exaggerate the importance of this subject, and it is to be hoped that with the assistance of the able officers which the Government have at their service some really energetic steps may be taken.

I gather from reports kindly furnished to me from Mr. Gill that in South Australia the area inclosed for planting operations was, on the 30th June, 1894, 11,425 acres, and that during the year following that date an additional area of 320 acres was added. This is a good start for a colony where indigenous timber of value is scarce, and I sincerely wish success to Mr. Gill's efforts.

In order to prove what a hold this question has already obtained upon the practical commercial mind in America, I quote the following from the Century Magazine of September last :—

"During the present year the advocates of a modern forest policy have received the important support of the two leading mercantile organisations of New York City. On January 3rd, 1895, the New York Chamber of Commerce, after special consideration of the subject, adopted unanimously the following resolutions :—

Whereas, A thorough inquiry into the question of the preservation of our forest lands is of permanent importance to agricultural and other interests, thereupon be it

Resolved, That this Chamber recommend to the United States Senate and House of Representatives in Congress assembled, to pass a Bill which authorises the President of the United States to appoint a Commission of three experts and make the necessary appropriation for the purpose or a thorough study of our public timber lands, so as to determine what portions ought to be preserved in the interest of the people, to prepare a plan for their management, and report the same within a year of their appointment. The Commission to have access to all public documents bearing on the subject.

On June 12th, 1895, a similar meeting was held by the New York Board of Trade and Transportation, and after discussion of the larger aspects of the subject the following resolutions were unanimously adopted :—

Whereas, The welfare and the commercial interests of the entire country are closely related to the preservation and proper management of the public forests.

Resolved, That as a first step to a permanent and scientific forest policy, we heartily favour the creation by Congress of a National Forest Commission with the following objects :—

1. To study the public timber lands, reserves and parks, on the ground.
2. To ascertain their condition and extent.
3. To ascertain their relation to the public welfare and to existing local needs of the people as regards agricultural and the supply of wood for mining, transportation and other purposes.
4. To ascertain what portions of the public timber lands should remain as such in view of the agricultural, mining, lumbering and other interests of the people.
5. To prepare a plan for the general management of the public timber lands in accordance with the principles of forestry.
6. To recommend the necessary legislation ; and

Resolved, That the Special Committee on Forestry be directed to communicate with other commercial bodies and with Congress in furtherance of concerted action on this important question at the next session."

The study of the fossil remains of plant life of past ages in this country has of late years received some attention. Professor Ettingshausen, of Graz, has had the lion's share in this work, and as he has expressed views as to the origin of the vegetation of Australia, and of the rest of the world, which appear to be entirely erroneous, and as they appear to be tacitly accepted by Professor Tate in his Inaugural Address to the Adelaide meeting of the Australasian Association for the Advancement of Science, I desire to say some words on the subject, in the hope that some of our New South Wales Botanists and Palæontologists may take the matter up and corroborate or disprove the deductions which, in my opinion, can be made.

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Generally speaking, Professor Ettingshausen's theories amount to this, that in Tertiary times, or earlier, there was a universal flora of mixed types, which later on, through the influence of floral climates, became sorted out, so that at the present day distinct regions present distinct peculiarities which at first did not exist.

That the Australian region has now a flora of its own more marked and peculiar than perhaps that of any other region of the earth's surface will be disputed by none. At first sight this circumstance seems to have a parallel in the existence of types of land mammals, stragglers only of which are to be found elsewhere, and this view is apparently strengthened by the fact that in past ages monotremata and marsupials lived in Europe, while, according to Unger, Heer, Ettingshausen, and a few others, Australian types of plants, Eucalypts, Proteaceæ, Casuarineæ, and many others also flourished.

The subject is one well worth careful investigation.

The monotremata we know first made their appearance in the Northern Hemisphere in the Triassic Age, and marsupials of low type are first found in the beds of the Oolitic (Jurassic) Series. In the rest of the Mesozoic series no animals of higher development than marsupials have been discovered, but no sooner do we reach the Eocene than it is evident that an enormous advance has been made, for we find ourselves surrounded with animals of much higher type, including the reputed ancestors of the horse, deer, antelope, squirrel, hedgehog, bear and others. Many remarkable animals existed also of types that have long died out. Searching upwards through the Oligocene, Miocene, and Pliocene, and continuing into the Pleistocene we find, as the meaning of those names implies, more and more resemblance to the animals now living outside the Australian region, while at the same time we still keep sight of a few marsupials having affinities to the American opossum. This progression of types is utterly wanting so far as has been discovered in Australian strata, and it is only in the Pliocene beds that we first come upon undoubted proof of the existence of

mammals, and then we find all at once an abundance of highly differentiated marsupials with monotremes whose descendants comparatively little changed in type we have around us at the present day. That these highly differentiated Australian types had no representation, so far as is known, outside Australia, except in the extreme south of the American continent, is a fact full of significance.

It would appear then as if at the end of the Mesozoic period before the evolution of the higher orders of mammals took place there must have existed a territory already inhabited by marsupials, which then became cut off from the rest of the land to the north, and that in this land—a portion of the pre-existing Gondwana Land of Suess, or Antarctica of Forbes—the differentiation of the marsupials occurred, and that further this land, which may have been shifting in character, was at the end of the Miocene or beginning of the Pliocene, connected with Tasmania. Mr. C. Hedley's paper on the "Surviving Refugees of Antarctic Lands," read before the Royal Society of New South Wales last year, deserves thoughtful consideration.

I have devoted some space to the above matter because it bears on the question of the origin of Australian Vegetation. It is clear that the peculiar Australian types could not have been immigrants by the same route as the marsupials, or, indeed, immigrants at all, but the above considerations show the great probability of the existence of extensive land surfaces in the Antarctic regions at the end of the Mesozoic and in the earlier Tertiary times; that the connection with more northern lands was of a somewhat fleeting character, and that while it permitted of the passage of one element of the Australia Flora from South America to Tasmania, the succession of these fluctuating land surfaces did not allow of any large migration of Australian types in the opposite direction.

In his "Introduction to the Flora of Tasmania," published in 1860, Hooker sets forth the facts connected with the distribution of plant life in Australia and Antarctic lands. This able work is still the best complete treatise on the subject, and only requires

to be brought up to date by utilising the results of the investigations of Baron F. von Mueller and others to make it of full value at the present day.

Hooker points out that what appears to be the indigenous vegetation, and which is, taking the whole continent together, by far the most important both in numbers and characteristics, has been added to in different ways. The coast strip of the north and east has been subject to an invasion of Indian and Malayan forms. These are quite distinct in character from the true Australian ones, which seem to have had their centre of distribution in the south-west portion of the continent.

Mixed up with the flora of the eastern part of Australia, and especially in the south, is a group of plants from the northern temperate regions, which seem to have forced their march upon Antarctic lands by following down the Andes chain to the extreme point of South America, leaving traces on the way, and thence stepping across by land links, which once existed but have now disappeared, the gaps between that continent and New Zealand and Tasmania. This element of the flora is most largely represented in New Zealand and Tasmania, but has also pushed its way up Eastern Australia, particularly affecting the higher mountain tops as they proceed northward, and we even find representatives on mountains of great elevation in New Guinea, and Borneo*

It is remarkable that among the plants thus introduced into Australia there are 17 European species, most of which occur in Britain.

It is almost needless to remark that the typical Australian types are with few exceptions absent from New Zealand.

Hooker further draws attention to the remarkable similarity in character existing between the vegetation of South Africa and

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* Trans. Roy. Soc. Vic. Vol. II. Mueller, "Plants of Owen Stanley Range in British New Guinea."

Trans. Linn. Soc. Botany, Vol. II. Part 2. Dr. Stapf, "Flora of Mt. Kinabalu in North Borneo."

Australia. The principal natural orders and groups, which by their abundance produce this result, are the following :—

Proteaceæ, *Compositæ*, *Irideæ*, *Hæmodoreæ*, *Polygaleæ*, *Restiaceæ*, *Ericaceæ* (corresponding in South Africa to *Epacrideæ* in Australia), *Papilionaceæ*, *Rutaceæ*, *Thymeleæ*, *Santalaceæ*, and some others.

This looks like parallelism of development from a common origin.

Below is a list of the more important groups, natural orders, tribes, genera or parts of genera, as the case may be, which serve to make up the peculiar and predominant element of the Australian Flora. The orders *Proteaceæ*, *Ficoideæ* and *Restiaceæ* are markedly South African as well. Outside the Australian region and South Africa some scattered representatives of the groups mentioned are to be found. These have the character of escapees; compared with the allied Australian species, their number is insignificant, and one cannot avoid the conclusion that Australia, or some southern land of which Australia is a remnant, was the origin and home of the various races. It is true that some of the outside representatives of Australian types are now separated by wide gaps of ocean from their congeners, but Wallace, in his "Island Life," has shown how plants can thus cross serious obstacles without the existence of actual land connexion. Some of the wanderers are dwellers near the seashore, and thus always ready, as it were, when the means presents itself, for transport by sea. Some have travelled in the reverse direction to the Indian and Malayan immigrants, while others have reversed the order of march of the European invaders already referred to, and have passed up the Andes.

Typical Australian Groups.

Dilleniaceæ.—Tribe *Hibbertieæ*.

Pittosporeæ.—All genera except *Pittosporum*.

Tremandreæ.

Rutaceæ.—Tribes *Boronieæ* and *Zanthoxyleæ*.

STACKHOUSIEÆ.

LEGUMINOSÆ.—Tribe *Podalyrieæ*, &c. Phyllodineous section of genus *Acacia*.

HALORAGEÆ.—Genus *Haloragis*.

MYRTACEÆ.—Capsular Group.

FICOIDEÆ.—Genus *Mesembryanthemum* and *Aizoon*.

STYLIDIEÆ.

GOODENOVIEÆ.

EPACRIDEÆ.

MYOPORINEÆ.

LABIATÆ.—Tribe *Prostantheree*.

PROTEACEÆ.

THYMELEÆ.

CASUARINEÆ.

ORCHIDEÆ.

JUNCACEÆ.—Tribes *Xeroteæ* and *Xanthorrheæ*.

RESTIACEÆ.

Wallace in his "Island Life," the first edition of which appeared in 1880, gives his views as to the point of origin of the Australian types. He places this in the south-west of Australia and assumes the possibility of extension of the land outside its present limits. The western half of Australia was cut off, he says, from the eastern half by the Lower Cretaceous Sea which ran right through the centre of what is now Australia, from north to south. He accounts for the existence of Eastern Australian forms of the typical vegetation by the assumption that they crossed this barrier in the same way as it is known that plants in course of time find means of leaping gaps of great width. This eastern portion is stated to have been in Cretaceous times of limited extent and to have derived most of its vegetation from the land surfaces to its north and north-west, in fact from the Indo-Malayan region.

Professor Tate in his address to Section D. of the Aust. Assoc. for the Advancement of Science in Sydney, 1887, divides the flora of Australia, as follows :—

I. Immigrant.
   a. Oriental.
   b. Andean.

II. Endemic.
   1. Euronotian or eastern.
   2. Autochthonous or western.
   3. Eremian or central.

He says that between the Euronotian and Autochthonian a barrier always existed ; in Cretaceous times it was to a large extent lacustrine, later on the lakes dried up and the present desert barrier formed.

His conclusions are : (1) that the Australian flora is of high antiquity ; (2) that the Autochthonian constituent was dismembered in Cretaceous times and, (3) that the Euronotian constituent was modified during very early Tertiary times by a primitive cosmopolitan flora.

I do not see much to dispute in the above except the supposed existence of a cosmopolitan flora, which is a mere assumption.

Now let us see what is to be learnt from the study of fossil plants as to the former land surfaces of the southern hemisphere.

In the Australian Coal Measures, which are now acknowledged to be of Permo-Carboniferous age, there is a remarkable absence of the plants which abound in contemporaneous beds of the northern hemisphere, but instead of this we meet with an enormous development of *Glossopteris*, *Gangamopteris*, and other genera of ferns which do not occur in the northern hemisphere till a much later epoch. These forms are found over a very large area of the earth's surface, not only in Australia, but also in India and South Africa, and it has been recently announced that a remarkable affinity with the Australian and Indian Carboniferous fern flora has been traced in Argentina in South America.

Judging from these facts, there is little doubt that in Permo-Carboniferous times an isolated Austral region of vast extent existed.

The discovery just referred to can be best described by quoting from a Note in "Nature," Vol. LII., p. 523; and its importance is expressed in an extract from a letter of Mr. W. T. Blandford to the same journal, Vol. LII., p. 595:—"The latest number of the *Records* of the Geological Survey of India contains a translation of a paper by Dr. F. Kurtz on the Lower Gondwana beds of Argentina (from *Revista del Mus. de la Plata*). In this is recorded an important discovery of plant remains in shales at Bajo de Velis. These fossils are well preserved, and while being quite different from the Argentine plant-remains already found, show a close affinity to the plants of the Kaharbari beds of the Lower Gondwanas of India, as well as to those of the Ekka-Kimberley beds of South Africa, the Newcastle and Bacchus-Marsh beds of Australia and the Mersey beds of Tasmania. The previously known plant-bearing beds of Argentina consisted of two series—one containing a Rhaetic flora, resembling that of the Stormberg (Upper Karoo) beds of South Africa, the Hawkesbury beds of Australia, and the Rajmahal (Upper Gondwana) series of India; the other containing a flora of Lower Carboniferous character. The newly discovered flora must be intermediate in age between those two—that is to say, it cannot be older than Upper Carboniferous, nor younger than Triassic; and with it must go the flora of the important coal-bearing Upper Gondwana beds of India. These have already been assigned to the Upper Carboniferous (at lowest) by Messrs. Medlicott and Blandford, and the Indian Survey, and the new discoveries in Argentina give a satisfactory confirmation of their views."

Writing on this discovery Mr. W. T. Blandford says (see "Nature," LII., p. 595):—"It is difficult to understand how two floras, differing from each other far more widely than do any two continental floras living on the earth's surface at the present day, can have co-existed, unless there was for a long period of geological time a great southern continent—the Gondwana-land of Suess—

isolated by a wide sea, probably an ocean, from the land that occupied in Carboniferous and Permian days so wide an area in the northern hemisphere. The importance of the new discovery is the immense extension that is given to Gondwana land and the proof it affords that the region with its flora extended to the western hemisphere and included a part at all events of South America. This appears to indicate that a considerable area now occupied by ocean in the southern hemisphere was land in the Carboniferous period. Further research is needed to show whether the various tracts of Gondwana land were connected by a South Polar land area."

A region like the above if of long continuance would form a favourable centre of development for the higher forms of vegetation. We have already indications that Dicotyledons existed in the southern hemisphere at an earlier age than in the northern. Is it not therefore possible that the *Proteaceæ*, at least, which, as Bentham has shown, represent—especially the Tribe *Nucamentaceæ*—a very ancient type, may have here originated? While the connection of this land with South Africa and Australia continued, opportunity would be afforded for the colonisation by *Proteaceæ* of both countries, and the subsequent subsidence of the connecting links would result in the present separation into two divisions of one group of plants. The close alliance of other groups of phanerogams in South Africa and Australia has been already referred to, and there are not wanting botanists who consider that it was in the southern hemisphere that the evolution of the higher orders of plants commenced.

The *Coniferæ* are a very ancient group, and they do not appear to furnish reliable data from which the distribution of land and water in past ages can be deduced. *Coniferæ* make their appearance in Carboniferous times both in the northern and southern hemispheres. *Araucaria* comes into view in the Jurassic Period in the northern hemisphere. The genus is a remarkable instance of persistence of type, a character which also applies to the species. In China remains closely allied to our *Araucaria Cunninghamii* have been found, and in the Bagshot Sands at

Bournemouth in England branchlets and scales have been discovered which are scarcely distinguishable from those of our species abovenamed. Fossil remains of the genus have been found in Europe, North America, China, the extreme south of South America, Tasmania, E. Australia, and even the Island of Kerguelen. Living species occur in North-east Australia and adjacent islands, Chili and Peru.

The genus *Dammara*, the best known example of which is the New Zealand Kauri, now exists in Queensland, New Zealand, Borneo, Celebes and the Philippines. Remains obtained from the Cretaceous rocks of Greenland have been referred to this genus, but the identification is somewhat uncertain.

Araucaria is not typical of any country; and the same may be said of that other ancient group the *Cycadeæ*, which have had a world-wide distribution. It is necessary to draw attention to this, as the fact of their existence in certain strata in the northern hemisphere has assisted in the drawing of false comparisons between the tertiary vegetation and climate of Southern England and those of Australia of the present day.

The first undoubted appearance of Dicotyledons in Europe is in the Upper Cretaceous Beds, and there they are found in large numbers, as if an invasion of those forms after collecting strength elsewhere had just taken place.

The oldest examples of dicotyledonous plant remains in Australia hitherto brought to light are some obtained by Mr. H. C. Stokes about three years ago in some railway cuttings near Brisbane. These fossils were sent by Mr. Etheridge to Baron Ettingshausen, who pronounced them to be of Upper Cretaceous age from a consideration of their character which resembled European specimens from strata of that age. Mr. Etheridge informs me, however, that the beds in question are considered by Mr. R. L. Jack, Government Geologist of Queensland, to form part of the Ipswich Coal Measures, and as such are of Early or Middle Mesozoic age.*

The whole of the facts having reference to the distribution of plants and animals in the southern hemisphere seem to point to

* Geol. & Pal. of Queensland and New Guinea, p. 597.

the existence through long periods of geological time of large areas of land surface, and the discovery of dicotyledonous plant remains in the Ipswich Coal Measures containing types similar to those existing in Australia at the present day and the absence of any such fossils of corresponding age in the northern hemisphere point to the same conclusion. It seems highly probable that we have in store for us a series of most interesting discoveries whereby we may have revealed the primitive types of the Angiosperms and be able to trace at any rate their ancestry some considerable way back.

In the Journal of Botany, 1865, there is a translation by Seemann of a remarkable and sensational address delivered in 1861 by Professor Unger of the University of Vienna to his students, entitled "New Holland in Europe." In this address Unger gives an account of the supposed identity of a portion of the European Eocene flora with the existing flora of Australia. This was the first clear exposition of a theory which has found favour with certain European Botanists, although strongly contested by others.

Wesel and Weber had some years before this written a paper on the vegetable remains from the brown coal of the Rhine, and an abstract will be found in the Quarterly Journal of the Geological Society, Vol. XV. Hooker in a note on this subject in the Introduction to the "Flora of Tasmania" says:—"The Australian genera include *Eucalyptus*, *Casuarina*, *Templetonia*, *Banksia*, *Dryandra* and *Hakea*. I am not prepared to assert that these identifications or the Australian ones of the Mollasse are all so unsatisfactory that the evidence of Australian types in the brown coal and Mollasse should be altogether set aside; but I do consider that not one of the above-named genera is identified at all satisfactorily, and that many of them are not even problematically decided."

Unger begins his address by contrasting life at the present day in Australia with that of Europe, pointing out that in the one you have the lowest types of mammals and the lowest types of man as compared with the highest orders of mammals and the highest civilized man in the other, and then enters into a diatribe against

this "despised, decrepit, or scarcely born fifth quarter of the world" showing I venture to say much ignorance in so doing. He afterwards states that what was begun in Australia was transported to Europe by some supposed land bridge and there destroyed while Australia stood still, and the latter is now being threatened with almost total extinction, like the Pacific Islands. The Australian types represented in Europe were, according to him, Proteaceæ, Epacrideæ (through one leaf), Santalaceæ, Coniferæ and other orders. *Araucaria* is especially mentioned as abundant in some of the beds of Europe, and then he argues that the conditions which allow of these types now in Australia must have existed in Europe in Eocene times, and concludes that the climates were similar. He seems ignorant of the fact that *Araucaria Cunninghamii* grows in the humid brushes of the coast region, while *Banksia* and other genera are adapted to flourish under drier continental conditions and poor soil.

Unger requires other bridges for the explanation of his theories and one of them is that by which he supposes the European flora obtained a contingent from America, namely Atlantis.

The opinion that there was an identity of forms in Europe in Tertiary times and Australia of the present day took deep root, and was still held by Heer, and is now by Ettingshausen and others in spite of the fact that other botanists equally distinguished have proved the fallacy of the idea.

Among these latter is Bentham, whose work on the Australian Flora specially entitles him to authority. All Bentham's Presidential Addresses to the Linnean Society are of the highest value, and the one delivered in 1870 in which he specially devotes himself to the subject in hand, should be read by all interested in this subject. In it he ably contests the new views, and referring to Unger's tabular pedigrees of European forest races, he says that his speculations have been deduced much more freely from conjectures than from facts, aud he mentions that the great majority of fossil species are established on the authority of detached leaves or fragments of leaves alone. He then points out the unreliability of determination by leaves alone, and how even DeCandolle had

been in error even as to natural orders of specimens of which he possessed leaves alone, and he refers to Professor Flower who had pointed out that leaves belong to a class of structures that are aptly designated adaptive as opposed to essential. He next points out that some of Heer's determinations of *Podogonium* of the Caesalpineae where specimens of leaves, fruits, and even flowers, some of them still attached are conclusive, and that from their relation to existing plants point to certain conclusions as to climate; but in dealing with the reputed Australian groups he is strongly adverse. Speaking of Proteaceæ, he says "I have no hesitation in stating that I do not believe that a single specimen has been found that a modern systematic botanist would admit to be Proteaceous unless it had been received from a country where *Proteaceæ* were otherwise known to exist." As Mr. Bentham was especially engaged at the time in the examination of Proteaceæ, I cannot do better than make one or two short quotations in order to give his own words. "The analysis and detailed descriptions I have had to make within the last few months of between four and six hundred *Proteaceæ*, and consequent investigation of their affinities and distribution have shown that the Order, as a whole is one of the most distinct and most clearly defined amongst Phanerogams. I do not know of a single plant intermediate in structure between that and the nearest allied Orders which I cannot say of any other of the large Orders I have worked upon. There is, moreover, especially amongst the *Nucamentaceæ* a remarkable definiteness in the majority of genera without intermediate species, whilst the whole Order exhibits the greatest uniformity in some of its most essential characters, derived from the arrangement of the floral organs and the structure of the ovary and embryo, accompanied by a truly protean foliage. All this points in my mind to unity of origin, very great antiquity and long isolation in early times." Speaking of the so-called fruits of *Hakea* and *Embothria* as determined and figured by Ettingshausen but of which the internal structure is not visible, he says that some are "quite as much like those of several *Coniferæ*, or of certain genera of *Meliaceæ*, *Sapindaceæ* and various other Dicotyledonous

orders" and others "have a venation of the wing very different from that of any *Proteaceæ* I have seen, and much more like that of a real samara of an ash." After discussing many examples he says, "From the above considerations I cannot resist the opinion that all presumptive evidence is against European *Proteaceæ*, and that all direct evidence adduced in their favour has broken down on cross-examination; and however much these Eocene leaves many assume a general character which may be more frequent in Australia, (in Proteaceæ and other orders) than elsewhere, all that this would prove would be, not any genetic affinity with Australian races, but some similarity of causes producing similarity of adaptive characters."

The above remarks from a botanist so eminent and experienced in questions of the Australian flora as Bentham might well have been thought conclusive, but we find that Ettingshausen in 1890 brought out a work entitled "Das Australische Florenelement in Europa" in which he reasserts the existence of *Leptomeria*, *Casuarina*, *Exocarpus*, *Banksia*, *Dryandra*, and *Eucalyptus*.

The subject of fossil plants and their identification is ably treated in the "Handbuch der Palæontologie," Part II entitled "Palæophytologie." This work as stated on the title page was begun by Herr Schimper, formerly Professor at the University of Strassburg, continued and concluded by Herr Schenk, Professor of Botany at the University of Leipzig, and edited by Professor Zittel of the University of Munich. It was published in 1890.

Doubt is thrown on the identification of *Casuarina*, *Bursaria*, *Hibbertia*, and *Callicoma*. Speaking of the remains attributed to the capsular *Myrtaceæ*, Zittel says there is no necessity to fly to that explanation. As to *Proteaceæ* the conclusion appears to be the same as that of Bentham. The identification of *Leptomeria* is spoken of as being due to superficial resemblance to which weight is given without critical inquiry. I have looked carefully through Zittel's work and I cannot find that the correctness of the identification of any Australian forms is acknowledged except some fossils of the Upper Cretaceous which have been classed and named *Eucalyptus Geinitzii*.

It is to be observed therefore that all resemblances to Australian existing vegetation in the Tertiary flora is looked upon by Hooker, Bentham, Zittel and many others as fanciful and unproved. As regards the supposed *Eucalyptus Geinitzii* it will be noticed that the figure in Zittel's book reminds one of the style of growth of a Eucalypt, but the fruits are by no means like what exist at the present day. It is, however, just possible that here we have something like an ancestral example of the capsular *Myrtaceæ*, or indeed of the whole group of the *Myrtaceæ*, for it may be assumed that the fleshy-fruited section of the order developed by natural selection out of the hard-fruited one—community of type no doubt implies community of origin. There is, however, an element of doubt about the whole matter, as it is strongly to be suspected that the immediate ancestors of *Eucalyptus* in Australia had opposite leaves.

Be that as it may, however, there is nothing to prove that in Tertiary times any of the typical Australian groups existed outside Australia.

Pliocene fossil remains from Victoria have been investigated by Professor McCoy and Baron von Mueller; also specimens from Orange in this colony. The parts described consist of fruits and a few leaves. But Baron von Mueller has, I believe, steadily refused to classify leaves or fragments of leaves, and condemns the practice.

Some fossil plants from Dalton, near Gunning, and Vegetable Creek, in New South Wales, were sent by the late Mr. C. S. Wilkinson, Government Geologist, to Professor Ettingshausen, and they have been examined and reported upon by him. Professor Ettingshausen's two memoirs on the subject have been published in English by the Mines Department of Sydney in one volume, the book being edited by Mr. Robert Etheridge, Junr., now Curator of the Australian Museum.

The fossils consist almost entirely of leaves, and the strata are according to Mr. Wilkinson of Upper Eocene or Lower Miocene age, while those examined by Baron F. von Mueller are of Pliocene age. Mr. Etheridge does not accept any responsibility as to

identification from leaves. Baron Ettingshausen's conclusions are as follows :—He finds 98 species representing Cryptogams, Monocotyledons, Gymnosperms and Dicotyledons; and as he says the most important general result is this :—

"The Tertiary Flora of extra-tropical Australia is, as regards character, essentially different from the present living flora of Australia; nor does it closely resemble, in general, any other living flora. On the other hand, it shows the mixed character of the Tertiary Floras of Europe, the Arctic Regions, North America, and probably all the Tertiary Floras. It has also much more similarity to the Tertiary Floras at present known than to the existing flora of Australia. The characteristic plants of Australia are but feebly represented."

He finds such genera of the northern hemisphere as *Myrica*, *Betula*, *Alnus*, *Quercus*, *Fagus* and *Salix* represented. Of these we have at the present day *Fagus* only. There are other genera of East Indian origin, which is not to be wondered at, as we have such at the present day; but he also finds species of *Magnolia* allied to North American forms; *Bombax* of tropical America and some Oceanic genera which I think are much more doubtful.

These and other conditions seem to indicate to him an original universal flora in Tertiary times to which all the present existing floras of the earth may be traced back, and the evolution of the present flora from the Tertiary flora took place through the differentiation of the "floral climate"—whatever that may mean —which, however, was effected differently in different parts of the globe. (See History of the Development of the Vegetation of the Earth. Sitzungsb. der Acad. der Wiss. Wien).

As already referred to, further investigation has been made by Baron Ettingshausen as to some fossil plant remains found when excavating some railway cuttings near Brisbane rather more than three years ago. This gentleman made a preliminary investigation of them and submitted a report to the Imperial Academy of Sciences at Vienna on the 13th April, 1893. The presence of many of the Tertiary forms is apparent, and among them

Myrica, *Quercus*, *Fagus*, *Cinnamomum*, *Banksia* and *Eucalyptus* are found to be well represented.

I have not seen these, but I have carefully looked into the matter of the Dalton and Vegetable Creek fossils, and I cannot agree with the crucial determinations of Professor Ettingshausen, and I believe that his conclusions as to the character of the flora and its resemblance to the flora of other parts of the world are utterly wrong.

With the aid of Mr. R. Baker, F.L.S., of the Technological Museum, I have made comparisons between the fossil leaves and living ones, and so far as I have gone I find that the various types of fossil leaves are represented among existing plants and that there is no reason to go outside Australia to look for them. But even supposing the existence of the northern genera in Australian strata could be undoubtedly shown, Ettinghausen's deductions are still not valid, for *Alnus*, *Acer*, *Quercus*, *Myrica*, and others have to-day a wide range which brings them almost into close proximity to the Australian region, while species of *Quercus* have been actually proved to exist to-day in New Guinea, which is in the Australian region.

This portion of my Address has taken up so much time that I cannot on the present occasion do more than refer to one or two instances of what I consider faulty identifications, but I hope that during the ensuing year I may be able to present to the Society some further notes on the subject.

Fig. 1, Plate III., in Ettingshausen's work is named *Cinnamomum Leichhardti*, but the leaf represented is much more like that of *Smilax australis* or a species of *Rhipogonum*. It is not safe to conclude that all leaves with the *Cinnamomum* venation belong to that genus. *Litsaea dealbata*, which grows as far south as latitude 34°, and on Mt. Wilson at an elevation of 3,600 feet, and is not indicative therefore of tropical conditions, has the same venation. Baron Ettingshausen's specimens of *Acer* are much more likely to belong to *Sterculia*. The *Alnus* fruit it has been shown is probably a fragment of an *Araucaria* branchlet,

and the leaves attributed to *Betula* might equally well belong to say *Pomaderris betulina*.

There are many other examples which I have not time to give in detail now, but I have little doubt that all or nearly all the fossil leaves can be shown to possess the form and character of existing ones in the brush forests at the same latitude on the coast, and there is no necessity to search the world over for resemblances.

As to the statement that the Australian types are not proportionately represented, it is only a pity that Baron Ettingshausen is not better acquainted with the Australian flora of the east coast. He would find that in the dense brush forests of the coast Eucalypts and *Proteaceæ* become choked out and their place is taken by other types from the north. It is only necessary to suppose that the vegetation of the coast extended inland as far as Gunning or Vegetable Creek, a circumstance very likely to happen in the moister Miocene times, and one might have leaves preserved not of the open forest or scrub where the Australian types abound, but that of the brushes where the same are rare.

It is clear from the above considerations that the existence of the universal flora of mixed types assumed by Heer and Ettingshausen is not proved and that the extraordinary sorting operation which the "floral climate" was supposed to effect is grossly exaggerated. The absurdity of the supposition with regard to Australia seems to me extreme when it is remembered how many climates (not one alone) varying between hot and cold, moist and dry, Australia possesses. Eucalypts and other trees grow from east to west and from north to south of the country under the most variable conditions, and they will grow in other countries in the greatest luxuriance.

Further investigation of this subject should be persisted in, and the Tertiary and earlier beds of Western Australia may be looked to to throw light on the subject.

At present the facts seem to afford grounds for concluding—

(1) That many, if not all, the typical Australian floral types originated in Australia or in some land connected with it, but now submerged.

(2) That the assumption of the existence of a universal flora of mixed types at any epoch is unfounded.

(3) That the fossil plant remains of Tertiary age in Eastern Australia indicate a vegetation in all respects similar to that existing on the coast in the same latitude at the present day.

To them might perhaps be added a fourth conclusion of less certain character, but of high probability, that the *Proteaceæ* represent a most ancient type which had their origin at a time when not only extensive areas of land existed in the southern hemisphere but when some kind of connection more or less lasting existed between Australia and South Africa.

I take this opportunity of pointing out the danger of forming conclusions as to former climates from the character of vegetable remains. It has been not infrequently assumed that because leaves of *Cinnamomum* or other tropical types are found the climate must have been tropical, although the value of the argument is at the same time nullified by the acknowledged presence of leaves such as *Alnus* and *Betula*, belonging to the cooler temperate regions. The European temperate flora of the present day is very distinct from the tropical—it is cut off from the tropical flora of the same longitude by transverse mountain barriers and the Sahara desert, but on other parts of the earth's surface there does not exist this marked division. On the Pacific Coast of Asia tropical types reach Japan, while temperate types have advanced south into the tropics. Tropical types invade the valleys of the Himalayas, and on our east coast the same intermingling of types occurs. In Tertiary times probably these barriers to the spread of the different types did not exist in Europe and the tropical vegetation of the south or south-east was enabled to invade temperate latitudes as is the case on the eastern coast of Asia at the present day

I should like to induce Members of our Society to urge upon their friends scattered throughout the country to report any geological or palæontological discoveries which may come under their notice. There are so many interesting facts to be elicited, and the geological record in this country of ours is so broken up

and detached that when information can be obtained it is very precious. It often happens that fossils are found by those who are entirely ignorant of their value, and they are looked upon as fossils and nothing more, as if they were not each of them bits of history to be carefully treasured. If they are carried home they lie about for some time and are eventually lost. Such relics should be carefully preserved, the circumstances and manner of the find in each case noted and reported to the Department of Mines. I am certain that many interesting discoveries are lost to science through neglect or ignorance.

Another work that requires carrying out more fully and over a larger field than at present is the formation of local herbaria, including the forwarding of duplicate specimens to Sydney for identification. The knowledge of the distribution of plants in this country is far from complete, but it is a most interesting and important subject. Ladies residing in the interior, many of whom I know find their time hang heavily on their hands, would earn the gratitude of the scientific world if they would undertake to carry out this object, which would be more an amusement than a toil. Many districts are out of reach of ladies, and must be explored by the sterner sex. Local officers of the Government service should also be expected to assist. The great army of forest rangers, surveyors, road superintendents and others might have this work made part of their duties. Whenever an important commission is sent by the British Government for geographical research into a little known country, for the delimitation of frontiers or other serious work, a man of science is invariably sent to assist in the expedition. In this case as it were we have the new and undiscovered country close at hand. Why should we neglect our opportunities?

The additions to our knowledge of the natural history of Australia directly resulting from the operations of the "Horn Scientific Expedition to Central Australia" promise to be of the greatest interest and importance. Captain Sturt, the pioneer explorer in this region and its outskirts (1844-46), was also the first to furnish some insight into its natural history. In an

appendix to his "Narrative of an Excursion into Central Australia" he enumerates 10 species of Mammals, and 141 species of Birds met with during the course of the expedition. In the botanical appendix in the same work, R. Brown states that the collection of plants comprised about 100 species, though he enumerates but 26, chiefly the new genera and species represented. The discovery of the Alexandrine Parrakeet, and especially of *Notoryctes*, may certainly be allowed to count for a good deal; but otherwise it must be confessed that the supplementary zoological knowledge gained during the half-century which has since elapsed has not amounted to very much; and the progress made compares unfavourably with the advance in other branches, particularly in botany. Not many explorers in later days have failed to come within range of the persuasive influence of Baron von Mueller; and Professor Tate has been indefatigable in his efforts to accumulate natural history data in respect of both Tropical and Extra-Tropical South Australia. Consequently lists of plants with other botanical information will be found in almost every explorer's account of his travels, or in the Transactions of the Royal Society of South Australia. But we may look almost in vain for corresponding contributions to zoological knowledge. This, however, is not altogether a matter for surprise when allowance is made both for the natural advantage which the botanical collector has over his zoological confrère, and for the special difficulties—of collecting and preserving, as well as of transport—which have usually attended the steps of travellers in this part of the Continent, especially before the introduction of camels. Hence beyond the descriptions of a few miscellaneous species, which from time to time have come into the hands of zoologists, almost the only contributions supplementary to the information supplied by Sturt are (1) the lists of the incomplete collections of birds and molluscs obtained by Mr. F. G. Waterhouse; (2) Mr. Sanger's notes on the mammals and a few other forms, specifically undetermined, observed during two years' residence at Cooper's Creek; (3) Dr. Stirling's paper on *Notoryctes*; and (4) the important Reports of the Elder Expedition. This expedition, however, was persistently

attended by dry weather; its circuit took in West Australia, and its single naturalist had to divide his attention between botany and zoology.

There was, therefore, ample scope for a well-organised attempt to throw more light on the natural history of this remarkable tract of Australia. At the Adelaide Meeting of the Australasian Association, Prof. Tate, in his Presidential Address, expressed the earnest hope that "a systematic exploration of some well-known area, such as the MacDonnell Ranges," might become possible on the part of a well-known South Australian patron of exploration "as a crowning effort to unfold some of the mysteries of our dry interior." Not quite in the way Professor Tate had in his mind, but for practical purposes in an equally satisfactory way, through the liberality of Mr. Horn, the attempt was shortly afterwards made. And with what conspicuous success we may judge from the first instalment of the Report of the Expedition—Part ii. Zoology (4to. pp. 1-431, with 22 plates), edited by Professor Baldwin Spencer, recently issued. To this important work some little attention may worthily be devoted.

Leaving out of consideration the Hymenoptera (other than the Honey Ants) and the Hemiptera, the returns for which are not completed, we find that the Horn Expedition has added some 164 new species (Vertebrates 30, Invertebrates 134) to the general fauna of Australia. Taking all things into consideration this is a very substantial gain. Central Australia is not a region which could be expected to yield a varied fauna very rich in species. Some groups, well represented in other parts of Australia, but requiring a more or less humid environment, seem here to be wholly wanting, or but feebly represented.

As a contribution to the fauna of a particular circumscribed area of the Continent—the central portion of the Eremian Region, Larapintine Region as Prof. Tate now proposes to call it—the results are even more important. Again, leaving out of consideration the Hymenoptera (other than the Honey Ants) and the Hemiptera, we find a total of between five and six hundred species (Vertebrates 177, Invertebrates 358) assigned to it. This

at first sight seems a not very large census; and no doubt in time and under very favourable circumstances it will be to some extent increased. Every naturalist who resides for some time even in a good collecting district knows how long a time it takes to arrive at a complete census of the groups of its fauna in which he is especially interested; and how his experiences vary from year to year and from season to season. Still less is it likely that the zoological resources of an enormous area like Central Australia should be exhausted at a single attempt by visiting naturalists almost constantly on the move, however enthusiastic and assiduous they might be. From the experiences of Prof. Spencer we gather that if a zoological collector in Central Australia is to be successful in getting together a collection—not merely of skins of beasts and birds—but one at all representative of the general fauna, questions of time and patience must be of quite secondary importance. First of all he has to catch his animals—but in some seasons, and in the case of some of the most interesting members of the fauna, this is an unusually difficult task, and may entail long and patient waiting upon the rains, as well as securing the cooperation of the Aborigines. Should he arrive in a dry season he might without previous experience even wonder whether, except ants, there were any animals to be caught. The visit of the Horn Expedition was made during the winter months (May-Aug.) after good rains. But during the course of the expedition the rain kept off, the result being that a number of forms were overlooked, and many experiences were missed, and would have been missed altogether, had not Professor Spencer on his own account subsequently made a rapid supplementary journey to Charlotte Waters in time to see some of the more important but transient aspects of the transformation scene which the advent of good rains brings about.

Looking at the Larapintine fauna as a whole, we find it characterised by both negative and positive features. The negative characteristics are shown by the absence of many widely distributed Australian forms, or among the higher groups by the limited number of species of the types which do occur, or by the

complete or almost complete absence of representatives of orders which are abundant in other parts of the continent. This state of things is sufficiently accounted for by the arid nature of the country and its unsuitability for their maintenance, or by the effectual climatic barrier which keeps them out. Thus, it would seem that with the want of suitable perennial rivers and creeks may be correlated the absence of Platypus, just as the absence of forests accords with a dearth of arboreal Phalangers. Land Planarians, Peripatus, Terrestrial Amphipods and Isopods, and Slugs are among the other notable absentees (as well as Myriopods—possibly an unintentional omission).

Earthworms are poorly represented, only one species having been found. This—a species of *Acanthodrilus*—is a treasure which in quality compensates for some of the deficiency in quantity. It is a good instance of discontinuous distribution, and furnishes Professor Spencer with an opening for some interesting speculations. The genus is one which in Australia has lost ground, being at present but feebly represented in a few widely separated localities. Formerly when the rainfall was greater it was probably the dominant genus in the northern portion of the Continent, as it still is in New Zealand and elsewhere in the Southern Hemisphere.

Butterflies and Lepidoptera generally are not numerously represented. But the collection was made during the winter months, or rather during a dry spell, which will perhaps to some extent account for the scarcity.

The positive characters are shown chiefly in this—that the Larapintine fauna is a select assemblage of species which may perhaps be roughly classified as very hardy species, and as species which in habit or in structure have become specially adapted to live in an arid region, or which have been able to take advantage of some favourable external circumstances.

Some of them doubtless are the lineal descendants of forms which have uninterruptedly inhabited the region from a time antecedent to the setting in of the Dry Period, which proved so disastrous a change to forms like the Diprotodon. Others are

immigrants from very various directions. The new light thrown upon these matters by the naturalists of the Horn Expedition is one of the distinctive features of the Report. We get as it were hints and glimpses of adaptive relations to special surroundings in studying the fauna of the inland portions of the eastern colonies, but in Central Australia they reach a maximum. Here the struggle for existence takes on a new aspect. It is on the whole perhaps not so much a struggle among individuals as a struggle against climate, and all that that involves. As Darwin says: "When we reach the Arctic regions, or snow-capped summits, or absolute deserts the struggle for life is almost exclusively with the elements" (Origin, 1st Ed. p. 69). In Central Australia when a really good time comes, though some species have their numbers kept down by predaceous enemies or by a percentage of their progeny failing to complete their development in time, it must, though short, still on the whole be a very good time for a considerable proportion of the fauna.

When the drying-up process sets in again, then once more begins the struggle against the elements, and the need for special adaptation comes into play. The larger mammals endowed with great vitality, such as the kangaroo and the dingo, must weather it out or travel. The smaller mammals are nocturnal in their habits, often burrowers, able to put up with a minimum water supply, and a diet of ants or of dry herbage. The frogs are especially interesting as having in most cases superadded to a strongly marked burrowing habit a remarkable capacity for storing water within their bodies. The fishes are favoured in another way. In South Australia, Victoria, and Tasmania is found the pouched lamprey *(Geotria)* which in dry seasons is said to fill its remarkably developed throat-pouch with water, and then to æstivate buried in the mud. Of the Central Australian fishes Mr. Zietz is unable to report anything so striking as this. The piscine inhabitants of isolated shallow pools become extinct in dry periods, but others survive in the deeper permanent holes whence they may be afterwards again distributed by floods. Like the Batrachia, too, they have another string to their bow in the

possible dispersion of their ova through the agency of aquatic birds. Of the fluviatile Mollusca Mr. Sanger says that the Unios æstivate in the mud; that the gasteropods (five species) die when the creeks dry up, but that each flood stocks the creeks again, young ones in all stages of growth being met with in the flood waters. Some of the land mollusca are remnants which have found a haven of refuge of restricted area "on the southern escarpments of the elevated land or in the deeply shadowed gorges of the same," forming single colonies, or if more then widely separated. The Crustaceans are either burrowers like *Astacopsis* or *Telphusa*, or they are Entomostracans which like *Apus* develop only after their eggs have been dried up. The Honey Ants have learned to store up honey in a remarkable way, certain workers being set apart as receptacles for the honey collected by the other workers of the community.

An elaborate series of observations extending over several successive meterological cycles—if such were possible—would probably show a considerable corresponding ebb and flow both in regard to species and to individuals. In times of unusually prolonged and trying drought, the fauna in spite of the assumption of adaptive characters must still suffer severely; and recovery only become possible by a succession of very good seasons leading to increased fertility on the part of the survivors, or providing for the influx and establishment of immigrants.

Thus the Larapintine region furnishes an Australian phase of a state of things analogous to what obtains in arid regions in other parts of the world. In keeping with the characteristic and paramount claims of humidity, the call is for animals pre-eminently endowed with æstivating capabilities. In Central Australia in winter the winds are cold, and the nights frosty; but allowing for all this it is still a land of sunshine. It may even be called a land of perpetual summer by contrast with some parts of North America, of which Merriam says that the cold in winter is so intense that it is quite a common occurrence for trees five or six feet in diameter to be frozen to the heart. In so far as hibernation is due to the influence of intense

and prolonged cold, Central Australia makes but trivial demands upon its inhabitants in this direction. The power to withstand the effects of prolonged droughts—not merely to enter upon a "summer sleep" induced by high temperatures—in a high degree seems to be the all-important thing.

Respecting the most characteristic Eremian species a few points may be noted. Among the Mammals, *Notoryctes*, that curious marsupial modified for a burrowing habit, is pre-eminent. *Chætocercus* hitherto known only from a unique made-up skin, and from a locality not entirely above suspicion, now appears as a new creature. The new genus *Dasyuroides* is an important addition to the fauna. Very important are Professor Spencer's interesting observations on the indications presented by some of the smaller marsupials of a diminution in the number of young produced at a birth; and also of the irregularity in their attainment of full growth due to the effect of continued adverse seasons. Among the Rodents, Mr. Waite reports a species of *Mastacomys*, a Tasmanian genus with previously only a fossil continental representative.

The Birds include the rare *Spathopterus Alexandræ*, which, with the new species, five in number, is beautifully figured. Mr. Keartland's valuable ornithological field notes are a most important feature in this section of the Report.

From the Lizards may be selected two species referable to the genera *Ceramodactylus* and *Ebenavia*—the former previously known only from India and Persia, the latter only from Madagascar. This group seems to furnish the most striking instances of colour-adaptation—if, without any knowledge of the actual surroundings, we may so interpret the unfamiliar and startling brilliance and variety of tint displayed by some of the species figured from Professor Spencer's drawings from nature. Doubtless in this, as in other cases, the narrative portion of the Report will prove to be a source of much interesting information.

From the Mollusca may be singled out a species of *Microphysura*, a genus otherwise known only from New Caledonia; which provides an attractive speculative morsel for Mr. Hedley.

Viewing the results in their relation to geographical distribution some important considerations present themselves. The range of many known species is now for the first time considerably extended. Examples are the Echidna, *Sminthopsis murina* and *S. crassicaudata*, *Antechinomys*, five out of the six frogs, some of the birds and reptiles; among invertebrates the crayfish (*Astacopsis*), the freshwater crab (*Telphusa*), *Apus*, and others of the Entomostraca; and certain molluscs and insects.

Taking the different orders separately, some curious relations manifest themselves. Among the mammals along with characteristic and ubiquitous forms there occur also species found likewise in the inland portions of one or more of each of the mainland colonies. The birds, with the exception of five new species, Mr. North reports to be chiefly species ranging over the southern half of the continent, with a slight preponderance of western forms a slight admixture of north-western species, and an absence of northern species. Among the lizards, together with Eremian and widely dispersed species, there are northern and western forms. Of the frogs, one species is new: the remaining five occur also in the interior of New South Wales or Queensland only one of them (*Hyla rubella*) extending also to West Australia. The land Mollusca, of all the Orders represented, present the largest percentage of endemic forms; their general facies approximating more to that of subtropical West Australia than to any other part of the Continent. From the limited number of genera and their peculiar distribution Prof. Tate regards them as indicating a primitive group whose insularity has long been maintained. The fluviatile Mollusca, however, present species belonging for the most part to Queensland and the Northern Territory.

Considering the fauna of Central Australia as a whole, it will be seen that the regions into which Prof. Tate has proposed to subdivide Australia from botanical considerations are not equally satisfactory from a zoological point of view. Probably no one set of regional subdivisions would entirely suit the views of all specialists.

Another interesting point is strongly brought out. Central Australia furnishes the most striking Australian instance known of the "potency of climate compared with the inefficiency of physical barriers" in regulating geographical distribution. In an interesting address "On the Geographic Distribution of Life in North America," by Dr. Merriam, this author points out that Wallace* greatly underrates the importance of temperature as a factor in determining the distribution of animal life; and he adds: —"It is now pretty generally conceded that temperature and humidity are the chief factors governing the distribution of life, and that temperature is more potent than humidity." Australia is a continental tract, completely isolated, not reaching into very high or very low latitudes, without mountain ranges sufficiently high to reach the snow line, and its shores are washed wholly by tropical or temperate seas. It would seem that Merriam's dictum will not apply to the Eremian Region. In his important Presidential Address at the Sydney Meeting of the Australian Association for the Advancement of Science, Professor Tate said: — "The chief factors influencing the geographic distribution of plants are those of temperature and moisture, because they are indispensable; of the two, so far as Australia is concerned, the latter is by very far the more important." This generalization is now shown to apply equally well to animal life.

Finally, the Report furnishes confirmatory evidence as to the past history of Central Australia, as previously sketched by Prof. Tate and others. The elevated portions of the Larapintine region have continued to be land-surfaces since pre-Cretaceous times. They were insular members of the Archipelago whose shores were washed by the Lower Cretaceous Sea during the period of deposition of the Rolling Downs formation. During the deposition of the Desert Sandstone formation in Upper Cretaceous times they remained to some extent in the condition of islands, but the marine conditions had given place to a lacustrine order of things. With a favourable climate and abundant

* Proc. Biol. Soc. Wash. vii. (1892).

rainfall the partially reclaimed lacustrine area in Pliocene times was gradually opened up to immigration, until the central region must have supported a wonderful fauna including Diprotodon, Nototherium, large kangaroos, wombats, and crocodiles, &c. Of the remarkable flora which must have coexisted for the support of the gigantic herbivores, we know even less than of the extraordinary fauna. In Post Pliocene times set in the dry period which still continues. Such members of the fauna as could not adapt themselves to the new conditions were driven out.

The Botanical, Geological, and Anthropological Parts of the Report, as well as the Narrative, are still to come. In its complete form therefore this fine work bids fair to be the most comprehensive and complete account of the natural history of any part of Australia ever issued in a self-contained form.

In conclusion it would seem not out of place to tender the hearty congratulations of this Society to Mr. Horn, and to the accomplished naturalists who took part in the expedition, as well as to the various specialists who, in the more prosaic share of working up the material, have still done what they could to crown the work of the expedition with success. The amount of zeal and hard work which Professor Spencer in a three or four-fold capacity has expended on his share of the undertaking is evident enough from a mere inspection of the Report. The style and finish of Mr. Wendel's plates, mostly reproduced from drawings by Professor Spencer, as well as the letter-press, are as much a source of satisfaction as the contemplation of the fact that except in two groups it has not been necessary to go outside the limits of Australia to find specialists able and willing to undertake the necessary systematic work.

On the motion of Mr. R. Etheridge, Junr., seconded by Mr. J. H. Maiden, a very hearty vote of thanks was accorded to the President for his interesting Address.

The Hon. Treasurer read the financial statement of the Society's accounts. The report of the Auditors could not be presented, as one of them was still unavoidably absent from Sydney on official business.

The following gentlemen were elected

OFFICE-BEARERS AND COUNCIL FOR 1896.

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Thomas Whitelegge, F.R.M.S.
Professor J. T. Wilson, M.B., Ch.M.

Auditors :

Hugh Dixson, J.P.
E. G. W. Palmer.

The Meeting was then adjourned to April 29th at 8 o'clock p.m.

INDEX TO VOL. X.

(SECOND SERIES.)

Names in Italics are Synonyms.

PAGE

Acacia 587
aulacocarpa 513
Baeuerleni 583, 584, 585, 594
Baileyana 549
Bakeri ... 337, 339, 340
binervata 338, 339
decurrens 330
discolor 549
elongata 585
excelsa 338, 339
flavescens 339
Jonesii 513
lanigera 382, 383, 384, 385, 386, [584, 585
laurifolia 339
longifolia ... 332, 333, 334
Oswaldi 383
ovaria 340
phlebocarpa 584
pumila 385, 386
Simsii 584, 585
trinervata 385, 386
venulosa 383
Whanii 383
Acaste 487, 504
Adiantum æthiopicum 537
Adriana acerifolia 341
Aecidium compositarum ... 464
senecionis 464, 465
Æpyprymnus (*Hypsiprymnus*) 566, [578, 579, 581
Agrotis spina 407
Albizzia 587
Farnesiana 587
Hendersoni 586
Muelleriana 587
pruinosa 586
ramiflora 586, 587
Albizzia (Pithecolobium) Hendersoni [586
Muelleriana 585, 594

PAGE

Aleurites trilobata 210
Amblystoma 53, 54
Amphibolurus maculatus ... 472
pictus 472
reticulatus 472
Anastomus oscitans 219
Angophora lanceolata 530
Anolis 53
Antheræa eucalypti 209
Anthicus bembidioides 278
brevicollis 271, 272, 273, 274
cancellatus 275
delicatulus 280
exiguus 279
geminatus 278
inglorius 272
inornatus 277
lemodioides 274
luridus 272
ovipennis 279
pignerator 276
rectifasciatus 271
scutellatus 271, 273
simulator 277
strictus 278
triangularis 273
Wollastoni 274
Anthotium 361
Anthrenus socius 228
Aphanasium australe 325
Ardetta pusilla 219
Armeniaca vulgaris 456
Arses kaupi 171
lorealis 171
Arthropterus brevis 519
Asaphus caudatus 504
selenurus 503
Ascelis 201
Aspidium aculeatum 517
acuminatum 517
tenerum 537

PAGE

Asplenium 519
Astrotricha floccosa 329
Aterpus cultratus 327
Axides dorsalis 329
Balæna australis... 158
Balænoptera musculus 158
Sibbaldii 158
Balanoglossus canadensis 17, 19
kupfferi 19, 21
Balanophorus janthinipennis ... 262
Macleayi 261
Mastersi 261, 262
Banksia sp. 507
Barringtonia speciosa 210
Boronia mollis 512
Brachychiton 396
Brachyscelis 201
dipsaciformis ... 202, 205
rosæformis 204, 205
sessilis 203, 205
Thorntoni 204, 205
Brunonia 361, 371
Burramys ... 565, 566, 568
parvus ... 563, 564, 567
Bursaria spinosa... ... 286, 296
Cadmus flavocinctus 334
Caiman 485
Calymene odontocephala ... 503
Camponotus inflatus 472
Cardium flavum 409
vertebratum... 472
Carphurus 261
alterniventris 251, 252, 260
angustatus 250, 260
apicalis 259, 260
apiciventris 257, 261
var. dubius 257
armipennis 259
basipennis 259, 260
basiventris 251, 260
bifoveatus 258, 261
Blackburni 247, 259
carinaticeps... ... 248, 260
cervicalis 260
cristatifrons... ... 247, 259
cyanipennis ... 255, 258, 260
cyanopterus ... 251, 259, 260
elongatus 259, 260
facialis 259, 260
fasciipennis 250, 260
impunctatus.. ... 249, 260
latipennis 253, 260
lepidus 255, 261

PAGE

Carphurus longicollis ... 252, 260
marginiventris ... 259, 260
pallidipennis ... 259, 260
pictipes 256, 261
rhagonychinus 257, 259, 261
scapulatus ... 256, 259, 261
testaceipes 254, 260
Casuarius picticollis 614
Centropercis 320
nudivittis 320
Ceratopetalum gummiferum ... 513
Cercopithecus 571
Chalcis sp. 341
Chasmops... ... ... 487, 504
Chilocarpus australis 514
Cicada septemdecim 526
Cinnamomum Leichhardtii ... 550
Cisseis maculata 333
semi-scabrosa 334
Clypeaster Andersoni ... 315, 319
Blackmorei 317
collaris 314, 316
dorsalis 316
elliptica 319
fasciatus 315
nitida 317
Olliffii 318
pulchella 315
squalida 318
Coleosporium senecionis ... 464
Conus Waterhouseæ 471
Coprinus comatus 517
Coronura 487
Corycephalus 487
Cryphæus... ... ... 487, 503
Cryptocarya glaucescens 515, 516
var. *reticulata* 515
micronerura ... 515, 516, 518
obovata 516
Cryptochaeton iceryæ 549
Cucullæa 152
Cyclochila australasiæ 528
Cyclophorus 381
Kubaryi 380, 381
Cyclotus 380
Soembaenensis 380
Cylindrococcus 201
Cypræa annulus 520
arabica 520
assellus 520
caput-anguis 520
caput-serpentis 520
clandestina 520

PAGE

Cypræa comptoni 520
errones 520
errosa 520
felina... 520
fimbriata 520
flaveola 520
helvola 520
hirundo 520
interpunctata 520
lutea 520
macula 520
var. interpunctata ... 520
moneta 520
tabescens 520
vitellus 520
Cytherea 152
Dacnis westernensis 473
Dalmania 487, 502, 503
Dalmanites 487, 502, 503, 504, 508
caudatus 504, 508
Hausmanni 504, 508
meridianus 508
Dalmanites (Hausmannia) ... 502
Dampiera 361, 363, 365, 370, 371, [372
adpressa 369, 370
Brownii 363, 365, 366, 368, 369, [370, 371, 372
diversifolia 362
eriocephala 366, 368, 370, 372, [373
juncea 369, 370
lanceolata ... 369, 370, 372
linearis 364, 366, 367, 368, 370, [373
Linschotenii 368, 370, 373
loranthifolia... ... 368, 370
luteiflora 365, 367, 368, 370, 373
rosmarinifolia 362
sp. ... 367, 370, 373
stricta 366, 367, 368, 369, 370, [371, 372
Dasyurus 479, 560
Datura stramonium 336
Daviesia filipes 582
recurvata .. 582, 583, 594
squarrosa 583
Dendrolagus bennettianus 144, 521
lumholtzi 76
Didelphys... 51
Diplocœlus fasciatus 227
latus 228
punctatus 227

PAGE

Dircœa lignivora... 266
4-maculata 266
Doticus pestilens ... 330, 331
Dysoxylon rufum ... 338, 439
Ecatomma metallicum 519
Echidna 483, 556, 562, 572, 574, 576
aculeata 483, 559
Egernia depressa 472
stokesii 472
Elæocarpus 472
Baeuerleni 469, 470
eumundi 512
grandis 537
ruminatus 470
sericopetalus 470
Epeira sp.... 354
Epilachna corrupta 336
hirta 336
26-punctata 335
Erechtites... 461
quadridentata 466
Erinaceus.. ... 479, 480, 484
Eucalyptus 596
acmenoides 603
amygdalina 597, 598, 599, 600, 601, 602, 603, 606, 607, 608, 609, 610, 611
var. latifolia 599, 601, 603, [609, 610, 612
var. radiata 601, 602, 603, [606, 607, 608, 612
coriacea 597, 598, 599, 600, [609, 610, 611
var. alpina ... 600, 610
corymbosa ...328, 514, 528, 604
eugenioides 610
goniocalyx 605
hæmastoma ...529, 599, 600, 604, [610
var. micrantha 599
hemiphloia 602
marginata 436
microphylla 598, 611
pauciflora 598
piperita 600, 602
propinqua ...541, 542, 543, 604
punctata 541, 542, 543, 598, 604
radiata ... 606, 607, 608
resinifera 528, 542
robusta ... 216, 331, 528
saligna ... 541, 542, 543
siderophloia... 542
sieberiana 529, 600

PAGE
Eucalyptus sp. 203
stellulata 596, 598, 599, 609, [611
var. angustifolia... 598, 611
stuartiana 600
trachyphloia 514
viminalis 541
Eudynamis cyanocephala 215, 216, [217
Eurhynchus lævior 328
Euryischia lestophoni 549
Eutermes 417, 423, 424, 432, 433, [434, 435
destructor 422
rippertii 422
tenuis 420
Formicomus australis 271
elegans 270
Frenchia 201
Frenella robusta 341
Gehyra vorax 537
Geonemertes australiensis ... 342
Geoplana sanguinea 342
Gleditschia 587
Gleichenia dichotoma 537
Glochinorrhinus Doubledayi ... 307
evanidus 306
Glossopteris 519
Goodenia 361, 367, 371
geniculata 466
ovata 342
Gracilia pygmæa... 209
Gymnobelideus ... 568, 569, 570
Hakea acicularis... 325
Halmaturus ... 80, 84, 88, 99
agilis 76, 77, 78, 79, 82, 85, 90, [103, 114, 115, 118, 119
anak 99, 104, 109, 110, 132
browni 76, 78
cooperi 100, 112, 116, 117, 132
coxeni ... 76, 77, 78, 79
dorsalis 76, 77, 78, 79, 85, 118, [119, 120, 123
dryas ... 99, 109, 132
indra ... 99, 112, 132
minor... ... 100, 118, 132
odin 99, 111, 132
parryi ... 76, 77, 78, 79
ruficollis 76, 77, 78, 79, 82, 90, [106, 118, 119
siva 99, 113, 132
spp. 118, 119, 120
stigmaticus 76, 77, 78, 79, 85

PAGE
Halmaturus thetidis 76, 77, 78, 79
thor 99, 102, 131
ualabatus 76, 77, 78, 79, 85, 115. [118, 119
vinceus ... 99, 100, 131
vishnu ... 100, 114, 132
wilcoxi ...76, 77, 78, 79, 85
Hapale 571
Hausmannia 487, 502, 503, 504, 508
Angelini 508
auriculata 508
caudatus 507, 508
Hausmanni 508
longicaudatus 507
meridianus 504, 507, 508, 509, [510
rugosa 508
Helcogaster 261
brachypterus 244
canaliculatus 239
concaviceps 242
foveiceps 237
fuscitarsis 244
gagatinus 238
impressifrons 238
major 243
marginicollis 240
parallelus 241
ruficornis 239
tuberculatus... 246
varius 245
var. pallidipennis ... 246
Helichrysum adnatum ... 590, 591
bracteolatum ... 590, 591
brevidecurrens ... 590, 591
cinereum 590
decurrens 590, 591
diosmifolium 589, 590, 591
tesselatum 589, 590, 591, 595
Helicina suprafasciata 376
Helix Canefriana 374
Gorenduensis 378
(Geotrochus) Hedleyi ... 374
Kubaryi 377
mamilla 380
Quoyi 380
Tuomensis 375
Helodes scalaris 230
Hemiopsida Mastersi 230
Hemiplecta Blainvilleana ... 379
Fouilloyi 379
granigera 378, 381
Humphreysiana 379

PAGE

Hemipuccinia 450
Heteromastix bicolor 233
crassicornis 236
dilaticollis 234
gagaticeps 233
McDonaldi 234
mirabilis 235
Hodotermes 417
Hymenosporum flavum 512
Hypnos subnigrum 207
Hypsiprymnodon 566
Hypsiprymnus ... 373, 563, 566
Ianthina cærulata ... 209, 210
fragilis 210
Ibacus perouii 550
Icerya purchasi 549
roseæ... 549
Inuus 571
Iridomyrmex purpureus ... 428
Ives 7
balanoglossi 7
Kochia pyramidata 409
Lancestes lanceolatus 225
ocularis 224
Lastrea acuminata 517
Lemodes coccinea ... 283, 284
corticalis 284
elongata 282
Mastersi 283
Lepas Hilli 210
pectinata 210
Leschenaultia 366, 371
Lycaon Mastersi... 230
novus 230
Lycopodium gutbieri 519
macrophyllum 519
sp. 519
Macratria aberrans 269
analis... 269
australis 269
intermedia 268
Macropus... .. 80, 84, 88, 126
[560, 566, 578
anak 104, 106
atlas 97
brehus 104, 106
faunus 127, 133
giganteus 76, 77, 78. 79, 82, 90,
[96, 123, 124
goliah 89
magister 120, 121, 123, 125, 126,
[127, 128, 133
major... 581

PAGE

Macropus *mimas* 104
minor 118
pan 103, 124, 128, 133
parma 581
parryi 118, 119
rapha 89
rhæcus 104, 106
robustus 76, 77, 78, 79, 123, 581
ruficollis 581
rufus 76, 77, 78, 79, 123
titan 120, 121, 124
titan 120
Macromistria angularis 529
Mæchidius rugosus 331
tibialis 331
Malurus amabilis 355
brownii 355
Megalurus galactotes 217
gramineus 218
Megaptera boops 158
Melaleuca... 436
stellatum 328
Melampsalta encaustica ... 531
melanopygia ... 526, 531
Melia composita 327
Meliola amphitricha 439
Melobasis cupriceps 333
iridescens ... 332, 333, 334
splendida 333
Micromelo guamensis 520
Mimeta viridis 216, 217
Miniopterus 479, 481, 484, 556,
[571, 572
Schreibersii 481, 559, 562, 572
Mixotermes 417
Moloch horridus 472
Mordella æmula 293
albo-scutellata 295
aterrima ... 296, 297, 304
australis 288, 289
baldiensis 297, 304
bella 289, 290
cara 304
communis 289, 291
cuspidata 304
distincta 302
Dumbrelli 285
elongatula 304
felix 291
festiva 289
fugitiva 292, 293
fusca 298
H-fasciata 290

PAGE

Mordella humeralis 299
ignota 294
inconspicua 296
inusitata 294, 304
laticeps 287
leucosticta 285, 304
limbata 290, 291
longipes 303
Mastersi 293
multiguttata 285, 286, 304
nigrans 303
obliqua 304
18-maculata 286
pallida 300
pulchra 299
Raymondi 292, 293
ruficollis 304
rufipes 297
setipes 295, 298
6-lineata 294
Sydneyana 304
tristis 296
trivialis 291, 293
uniformis 297
V-fasciata 301
var. modesta 302
var. venusta 301
Waterhousei 300
Wiburdi 302
Mutilla sp. 341
Natica 152
Nautilus 544, 547
pompilius 544, 548
Nectris brevicaudus 550
Nephila 347, 354, 355, 356, 357, 358
aurosa 360
Cunninghamii 360
Edwardsii 349, 352, 353, 359, 360
flagellans 360
Fletcheri 347, 349, 352, 353, 360
fuscipes 360
imperatrix 360
nigritarsis 360
plumipes 357, 358
procera 360
sulphurosa 360
tenuipes 360
venosa 360
ventricosa 351, 360
victorialis 360
Odontocephalus 487, 503
Odontochile 502
caudatus 486

PAGE

Onychogale frenata 76, 77, 78, 79, 85
Ophelosia crawfordi 549
Opisthoscelis 201
subrotunda 201
Orchesia Macleayi 265
saltatoria 265
Ornithorhynchus 479, 482, 483, 484, 485, 556, 557, 558, 559, 560, 562, 574
Pachysiagon otuel 93
Palæopetaurus 569, 570
elegans 568, 570
Palorchestes 81, 84, 88, 103, 126
azael 81, 84, 85, 130
crassus 81
parvus ... 81, 84, 85, 130
Papuina 378
Hedleyi 374, 381
Kubaryi ... 377, 378, 381
var. albida 377
Millicentæ 376
Tayloriana 376
Tuomensis 375, 381
var. heterochroa... 375, 381
var. violaceo-flava .. 376
Parotermes 417
Patella cochlear 221
kermadecensis 221, 222, 223
Patella (Scutellastra) kermadecensis 221
Perameles... 479, 560, 578, 581
nasuta 561, 562
obesula ... 578, 580, 581
Peripatus 172, 176, 195
brevis 172, 177, 179, 180, 181
capensis 173, 174, 176, 177, 178, [181, 182, 189, 190
edwardsii 177, 190
insignis ...176, 177, 182, 185
juliformis 180
leuckarti 172, 173, 174, 176, [177, 182, 183, 185, 186, 196
var. occidentalis... .. 185
var. orientalis 186, 550, 618
var. typica 185
novæ-zealandiæ 173, 176, 182, [183, 184, 189, 190
oviparus ... 195, 196, 200
peruanus 176
Persoonia lanceolata 329
Petaurus ... 564, 566, 568, 569, 570
breviceps 569
Petrogale penicillata 76, 77, 78, 79, 85

PAGE
Petrophila pedunculata ... 516
Phacops 487, 488, 502, 504
caudatus 502
cephalotes 488
Crossleii 488, 489, 492, 495, 497, [500, 510
fecundus 488, 491, 492, 495, 497, [499, 500
latifrons 488, 495
latigenalis 488, 492, 493, 495, [500, 510, 511
mansfieldensis 488, 501, 510
rana 492, 495
serratus ...486, 488, 495, 497, [510, 511
Sweeti .. 488, 495, 497, 500, [509, 511
Phacops (Dalmania) 502
Phacops (Odontochile) 502
Phacops (O.) caudatus ... 504, 507
fecundus 497
Phascolarctus ...477, 578, 579, 581
Phragmidium 467
obtusum 466
Pimelia sp. 396
Piptocalyx Moorei ... 514, 517
Pithecolobium 587
Pittosporum revolutum... ... 326
undulatum 326
Platalea leucorodia 219
melanorhyncha ... 218, 219
Pleuracanthus 503
Podolepis... 588
acuminata 588
canescens 588, 589
Lessoni 588, 589
rubida 587, 588
Siemssenia 588, 589
Polypodium aspidioides .. 517
Portlockia... 487
fecundus 486, 488
Priocnemus bicolor 527
Procoptodon 88
goliah 89
goliath 89
otuel 93
pusio 89, 93
rapha 89
Prosopis 587
Protemnodon 88, 106
anak 88, 97, 104
antæus 104
mimas 104
PAGE
Protemnodon og 104
rhæcus 104
Prunus 450
americana 447, 456
amygdalus 455, 456
armeniaca 455, 456
domestica ... 455, 456, 457
insititia 455, 456
persica 455, 456
serotina 455, 456
sp. 459
spinosa ...441, 445, 456, 457
virginiana 456
Psaltoda flavescens 530
mœrens 529
spp. 532
Pseudochirus 566
Pteris tremula 537
Pteropus 482
edwardsi 482, 571
poliocephalus 481
Pterygometopus... 487
Ptychodera 1, 2, 16, 19, 20, 25, 26 [28, 29, 30, 31, 36
aperta 4, 20, 24
aurantiaca 4, 15
australiensis 1, 2, 4, 7, 11, 36, 41
bahamensis 24
clavigera 4, 15, 16, 24, 27, 28, 29
gigas 4, 15
minuta 3, 7, 8, 9, 11, 12, 16, 17, 18, 19, 20, 21, 22, 24, 26, 27, 28, 30, 31, 32, 33, 34, 35, 38
sarniensis 3, 9, 20, 31, 32, 35, 39
Puccinia ... 442, 461, 463, 467, 468
betonicæ 466
burchardiæ 448
conglomerata 464, 465, 466
erechtitis 465
expansa ... 464, 465, 466
glomerata 464
graminis 463, 466
pruni... . ... 440, 441, 442, 443, 447, 448, 450, 451, 453, 454, 456, 457, 458, 459, 463, 467
pruni-spinosæ 441, 453, 454, [456, 457, 458, 459
prunorum 441, 454, 455, 457
saccardoi 466
schoeleriana... 464
senecionis ...463, 464, 465, 466

PAGE

Puccinia tranzschelii ... 466
uralensis 466
Pupina Beddomei 379
complanata 379
difficilis 379
speculum 379
Raia asterias 207
batis 207
clavata 206, 207
Ratonia anodonta 512
Rhamnus catharticus 457
Rhina 207, 208
squatina 207
Rhinolophus ferrum-equinum ... 572
Rhynchosia Cunninghamii ... 513
Rhysota 378
Achilles 379
Scævola 364, 367, 371
ovalifolia 367
Selenurus granulatus 231
tricolor 232
variegatus 233
Selliera 364, 371
Senecio 461, 464, 465, 466
vulgaris ...462, 463, 464, 466
Sepia apama 209, 210
australis 209
capensis 209, 210
elongata 209
Sequoia gigantea 537
Sericoderus apicalis 313
basipennis 312
Coatesi ... 310, 311, 312
compactus 309
concolor 313
Hardcastlei 312
inconspicuus 311
lateralis 311
minutus 309
obesus 310
piceus 311
politus 314
Sosytelus rugicollis 305
Sphærio dactylus 356
Sphærococcus 201
Sphecius speciosus 527
Spirula peroni 210
Squalus acanthias 54
Stephanopis *hirsuta* 360
hispida 360
Sthenurus ... 88, 98, 112, 124
atlas ... 88, 89, 97, 104, 131
brehus 104

PAGE

Sthenurus goliah 85, 88, 89, 90, 93, [95, 97, 98, 131
minor 118
oreas 89, 96, 131
otuel ... 85, 89, 93, 97, [98, 131
pales ... ... 89, 94, 96, [98, 131
rapha... 90
Stipiturus malachurus 355
Strongylurus thoracicus 326, 327
Swainsona phacifolia 513
stipularis 513
Symphyletes nigro-virens ... 327
Synaptodon 129
ævorum 129
Syzetoninus basicornis 281
inconspicuus 281
parallelus 281
Tantalus leucocephalus... 219
Tatusia 479, 480
Tauroglossus 4
Tecoma australis ... 592, 593
Baileyana 592, 595
Hillii 593
jasminoides 593
Teredo sp. 519
Termes bellicosus ... 419, 430
dives 420
flavicollis 418
flavipes ..418, 420, 422, 435
grandævus 417
lucifugus 418
taprobanes .. 420, 421, 438
Termopis occidentalis 423
Thopha saccata 528
Threskiornis strictipennis ... 218
Tibicina sp. 532
Trichosalpingus lateralis ... 264
ornatus 262
pallipes 263
Trichosurus ...477, 482. 560, 566
vulpecula ... 479, 561, 562
Trimerocephalus 487
Triphragmium 467
Triphyllus intricatus 226
minor 226
multiguttatus 225
Tropidorhynchus corniculatus... 217
Tropidostethus 322
rhothophilus 323
Trygonorhina 207, 208
fasciata 206, 208

PAGE

Turnix leucogaster 519
Tychreus fasciculatus 307
Uredo prunastri 454
Urolophus testaceus 208
Uromyces... ...450, 451, 453, 467
amygdali 440, 441, 453, 454, [455, 456, 457, [458, 459, 467
pruni-spinosæ 458
prunorum 441, 455
var. *amygdali* ... 441, 455

PAGE

Vachellia 587
Velleya 361, 371
Vermicella annulata 472
Vespertilio murinus 572
Vesperugo pipistrellus 572
Viminaria denudata 333
Xanthorrhœa 396
Zosterops 356
cærulescens 472, 473
dorsalis 472
westernensis 473

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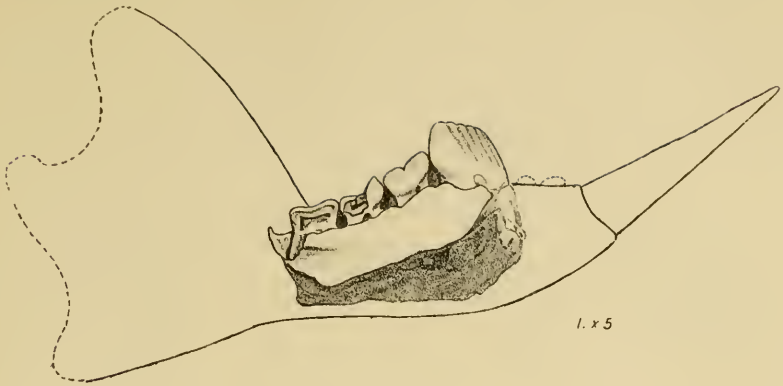

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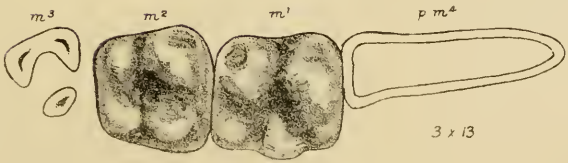

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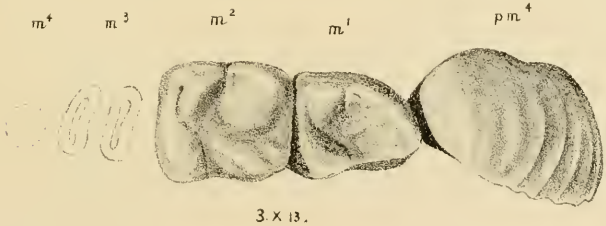

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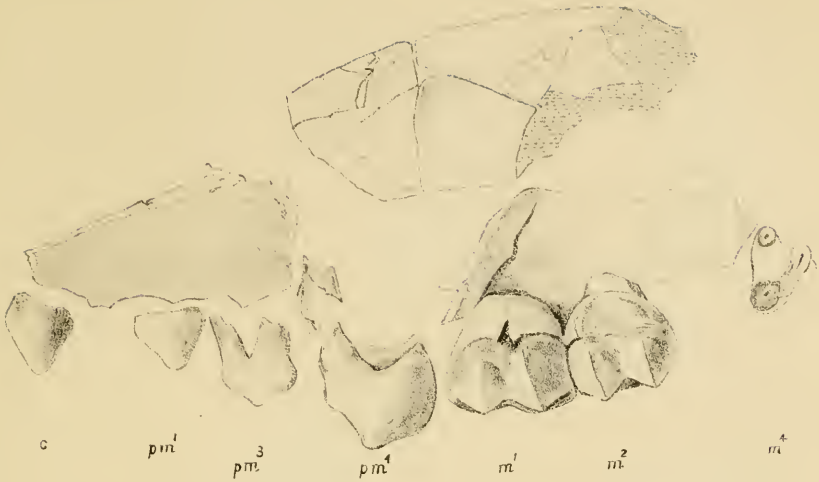
BURRAMYS PARVUS



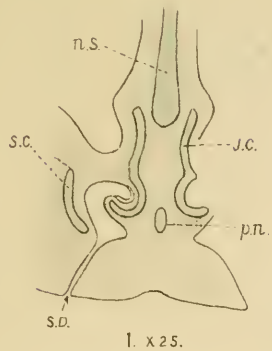
1. x 8-3.

2. x 4.

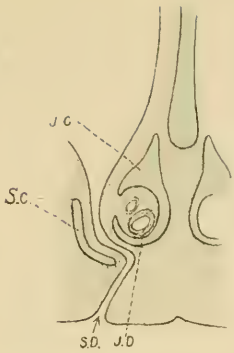
3. x 16

R.B. del. ad nat.

PALÆOPETAURUS ELEGANS.



1. X 25.



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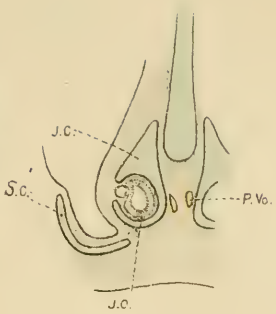

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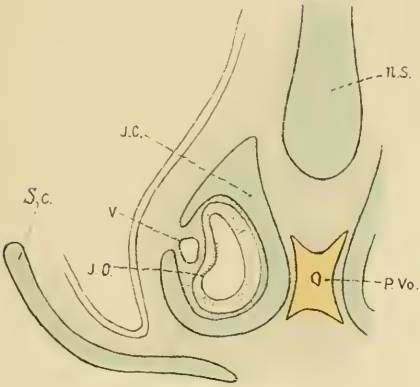
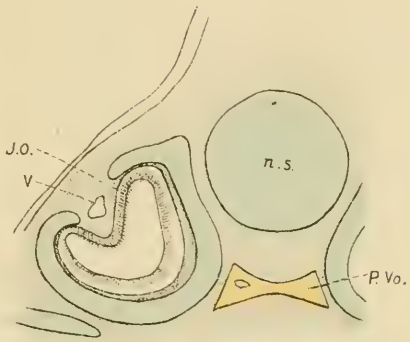
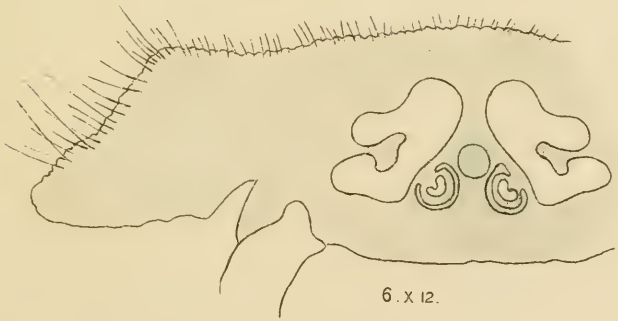


4. X 60.



5. X 60.



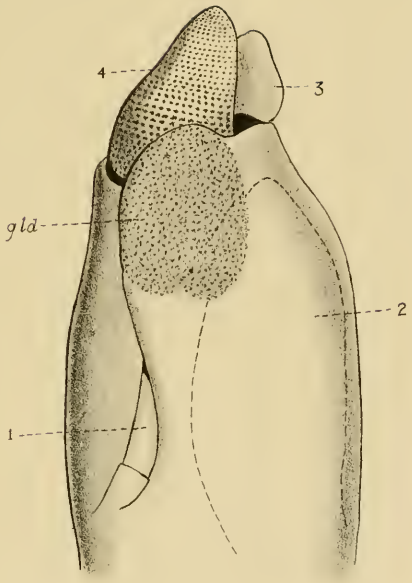
6. X 12.

R.B. del.

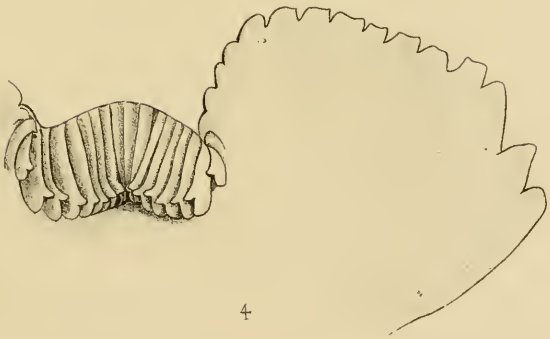
JACOBSON'S ORGAN IN MINIOPTERUS.

2

3

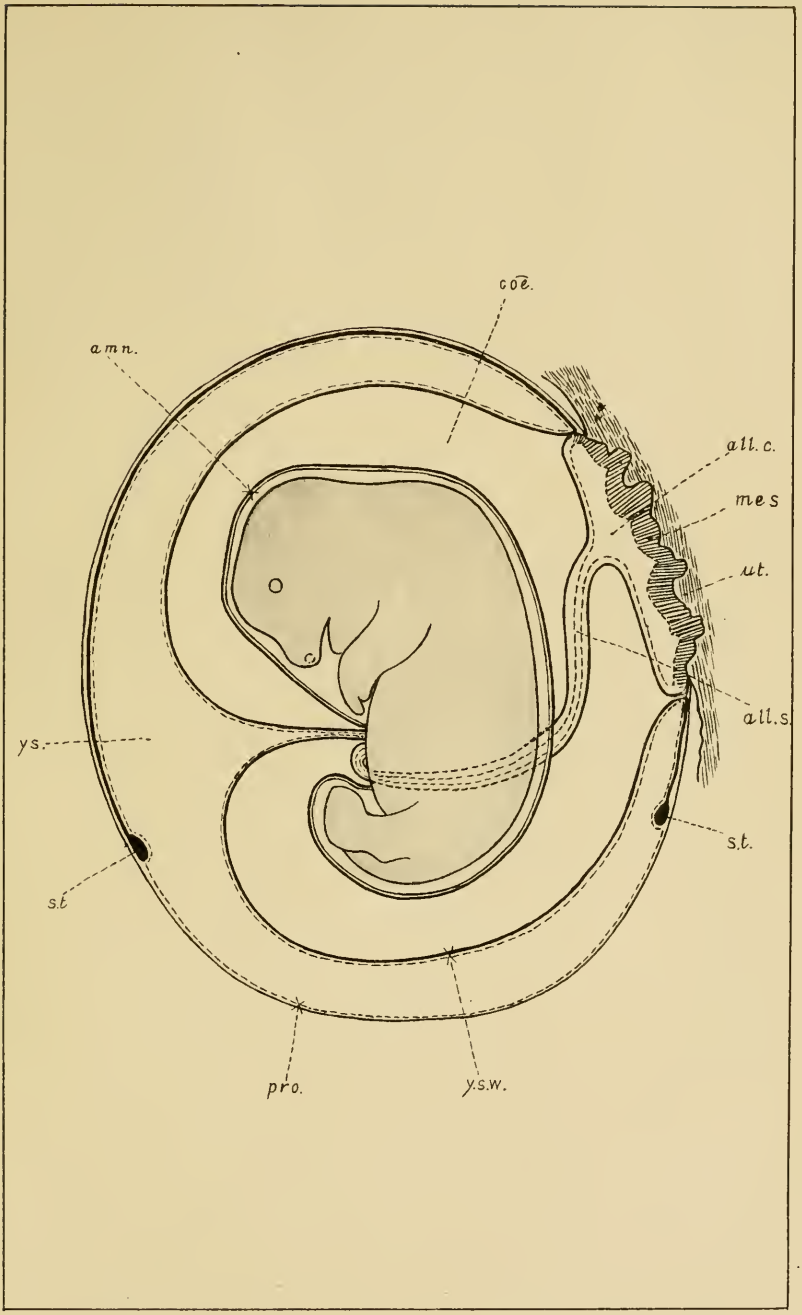


1



4

W. A. H. del.


coe.
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all.s.
ys.
s.t.
s.t.
pro.
y.s.w.

R.T. Baker del.

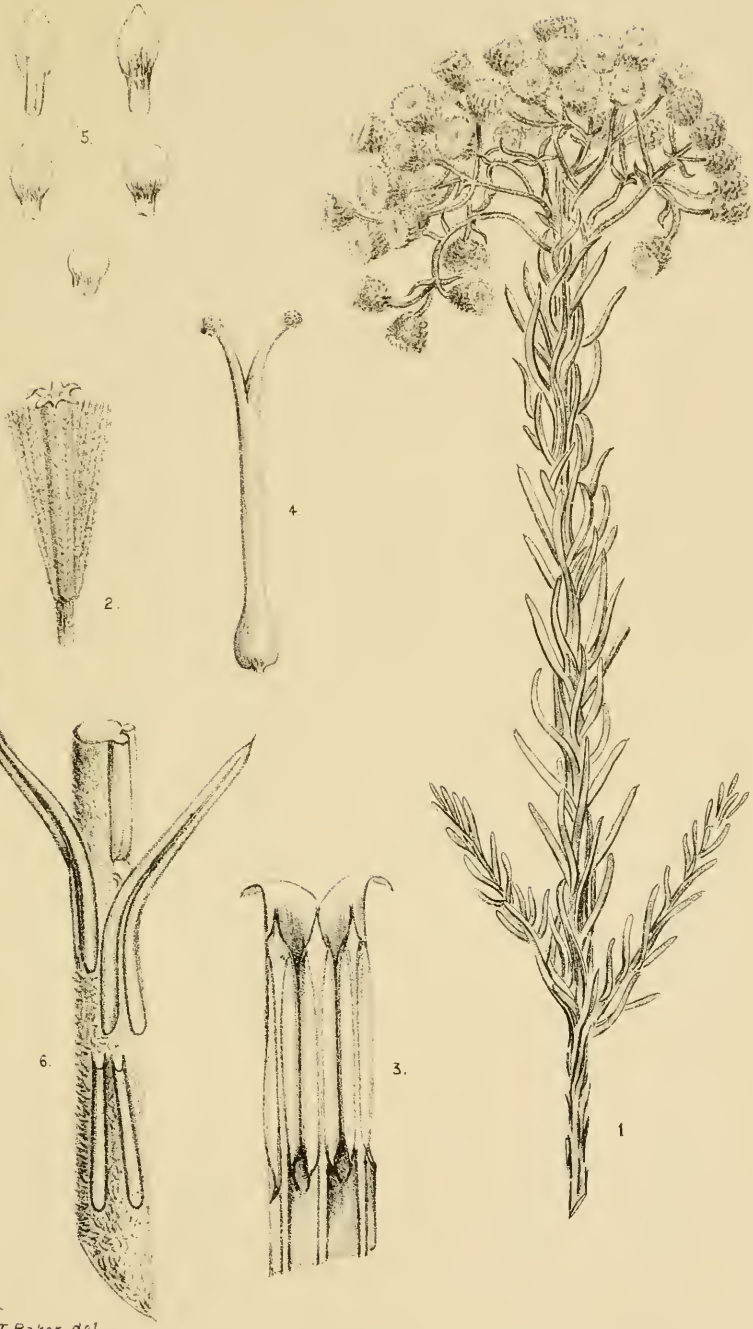
DAVIESIA RECURVATA, J.H.M. et R.T.B.

TECOMA BAILEYANA, *J.H.M. et R.T.B.*

ACACIA BAÜERLENI, *J.H.M et R.T.B.*

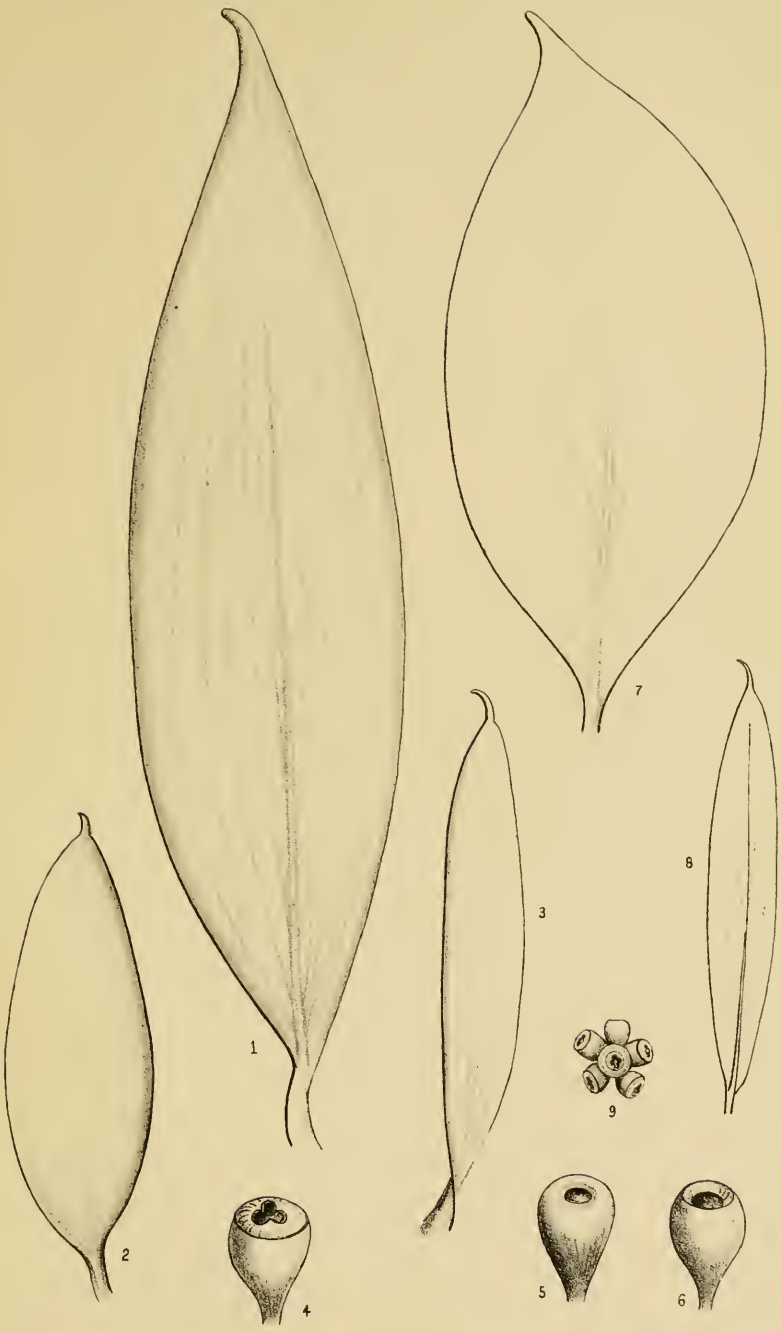
R.T.Baker, del.

ALBIZZIA (PITHECOLOBIUM) MUELLERIANUM, *J.H.M. et R.T.B.*



R. T. Baker, del.

HELICHRYSUM TESSELATUM, *J.H.M. et R.T.B.*



R.T.Baker, del.

1 to 6 EUCALYPTUS CORIACEA, 7 to 9 E. STELLULATA

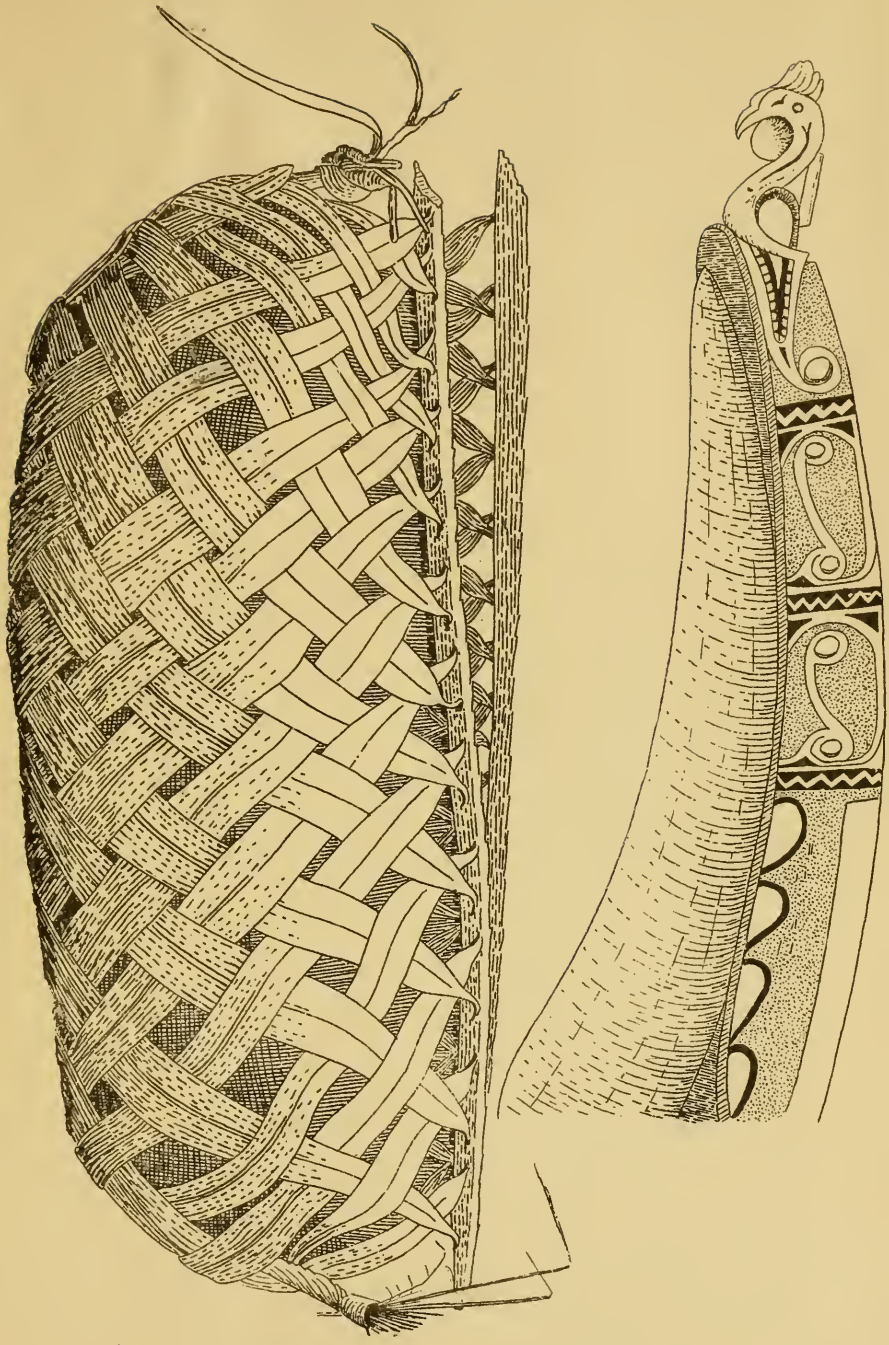
INSERT FOLDOUT HERE

R.T.B. del.

EUCALYPTUS AMYGDALINA
LABILL. VAR. RADIATA.

R.T.B. del.

EUCALYPTUS AMYGDALINA, LABILL. VAR. CATIFOLIA.



C.H. del.

PROPERTY OF
Z. P. METCALF